OVERCOMING BARRIERS TO ITS--
LESSONS FROM OTHER TECHNOLOGIES

FINAL REPORT

Prepared for the Federal Highway Administration

by

The Urban Institute
with
Cambridge Systematics, Inc.
Miller, Canfield, Paddock and Stone, P.L.C.
MTA/EMCI

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QUESTIONS SHOULD BE DIRECTED TO THE PROJECT MANAGER:

William A. Hyman
(Former Director, Transportation Studies Program, The Urban Institute)
Principal
Cambridge Systematics, Inc.
5225 Wisconsin Ave., N.W.
Washington, D.C. 20015
202-466-5542 (Ext. 208)
202-466-5548 (Fax)

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Co-Principal Investigators are:

William A. Hyman, Principal, Cambridge Systematics, Inc.
Former Director, Transportation Studies Program,
The Urban Institute

Harley W. Radin, Consultant

Other contributors to the project are:

Roemer Alfelor, Associate, Cambridge Systematics, Inc.
former Research Associate, The Urban Institute
Arlyn Fredrick, Senior Associate, Cambridge Systematics, Inc.
Jason Schrieber, Intern, Cambridge Systematics, Inc.
Harry Hatry, Program Director, The Urban Institute
Joshua Silver, Research Associate, The Urban Institute
Gene Steuerle, Senior Fellow, The Urban Institute
Timothy Ware, Administrative Associate, The Urban Institute
Diane Hendricks, Staff Assistant, The Urban Institute
Nicholas P. Miller, Leader, Telecommunications Practice,
Miller, Canfield, Paddock and Stone
Tillman L. Lay, of Counsel, Miller, Canfield, Paddock and Stone
Matthew C. Ames, Associate, Miller, Canfield, Paddock and Stone
Robert M. Jones, President, MTA/EMCI
Samuel H. Book, President, MTA Research
Susan Braman, Consultant
John Shannon, Consultant

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EXECUTIVE SUMMARY

This final report is a synthesis of the findings, conclusions, and recommendations of a series of task reports prepared under a major study that addresses how to overcome the institutional barriers to the deployment of Advanced Traffic Management Systems (ATMS) and Advanced Traffic Information Systems (ATIS).

I. SCOPE OF THE STUDY

This study examined the institutional approaches most conducive to the deployment of ATMS and ATIS. It explored the deployment of advanced technological systems in other arenas and focused upon the role of franchising.

The study first identified the key institutional barriers to deploying ATMS and ATIS through a literature review, interviews, and examination of the public comment docket for the U.S. Department of Transportation's report to the U.S. Congress on the non-technical constraints to the deployment of Intelligent Transportation Systems (ITS).

The study then examined the history of deployment of various products and services in fourteen other industries such as Cable TV, the electric utility industry, on-line computer services, and the National Weather Service.

Next the study looked at the full spectrum of possible institutional and procurement models for implementing ATMS and ATIS. The study looked at both pre-deployment and deployment models, recognizing that these two separate stages may require entirely different organizations and financing structures. Many of these models were distilled into generic categories that were used by the ITS America Task Force on Public/Private Partnerships.

Finally, the study looked at the potential role of franchising for the deployment of ATMS and ATIS. A precedent exists for this inquiry. More than twenty years ago the Urban Institute played a pivotal role in the deployment of Cable Television by preparing a model franchise agreement for Cable TV and providing centralized, expert advice to local communities. Rural and small urban areas found the model franchise agreement extremely helpful in de-mystifying this institutional framework and structuring and negotiating agreements with Cable TV providers. The preparation of the model Cable TV agreement helped to accelerate diffusion of Cable TV throughout the country.

This study concluded with the preparation of model franchise agreements for ATMS and ATIS. These model agreements offer guidance to those interested in franchising ATMS and/or ATIS. More importantly, these model agreements can serve as a check list of issues that need to be addressed when the public and private sector seek to develop any major agreement regarding how to provide ATMS/ATIS user services that both serve the public interest and generate a profit for private firms.

II. WHAT ARE ATMS AND ATIS?

Advanced Traffic Management Systems (ATMS) and Advanced Transportation Information Systems (ATIS) each constitute a constellation of user services within Intelligent Transportation Systems (ITS).

ATMS enables transportation departments to adjust transportation demand by altering the supply of transportation via pricing or access. ATMS user services include advanced technological systems to improve traffic flow through adaptive and integrated control of freeway and surface streets and through the improved management of incidents. ATMS requires the implementation of surveillance technologies, software for controlling traffic signals and ramp meters, and telecommunications between one or more traffic control centers and the roadside infrastructure. ATMS may also involve electronic toll collection.

ATIS user services include advanced information services to provide pre-trip travel information regarding the best transportation mode, departure time and route. ATIS services include en route driver information, possibly including the display of road signs in the vehicle. ATIS services also consist of route guidance which provides travelers simple instructions on how to best reach their destinations.

III. TAXPAYER AND CONSUMER WILLINGNESS-TO-PAY

Government will naturally concentrate on putting the ATMS infrastructure in place. It is likely to leave deployment of ATIS up to the private sector. ATMS user services, with the exception of electronic toll collection, tend to be "public goods," meaning that once provided to a single consumer, they are free to all and the consumption by one does not diminish the consumption by another. As a result, market pricing mechanisms do not work. Once such a service is available to one consumer, it is available to all. So consumers have no need to pay to receive the service. Therefore these services are not likely to generate revenues, a major barrier to the private sector deploying ATMS.

The ability of the public sector to deploy ATMS depends ultimately upon taxpayers' willingness-to-pay, unless there is cross-subsidization from selling ATIS user services or other products and services. A substantial unknown at present is what, if any, market can develop for ATIS services. Presumably ATIS service providers will create added value to traffic information generated by ATMS infrastructure, repackage that data and sell to end-user consumers, such as trucking companies and commuters seeking least-cost or least-time routing information. The actual market value of these data remains to be proven. To the extent ATIS does produce marketable information capable of generating substantial cash flows, then ATIS providers may be a possible and appropriate source of revenue to underwrite some or all of the costs of ATMS. Another possible source of money to support ATMS could be services which derive value from the public ownership and control of rights-of-way (e.g. the selling of "dark" fiber in conduit beneath the roadway surface to telecommunications

companies seeking additional transmission capacity). Cross-subsidy is only possible where buyers are willing to pay both the cost of the revenue generating services, plus enough to cover part or all of the ATMS costs.

> MAJOR FINDING: There is no greater obstacle to the deployment of ATMS and ATIS than lack of substantiated indications that taxpayers and consumers will be willing to pay for ATMS and ATIS user services.

Publicly available market research on the willingness of taxpayers and consumers to pay is woefully lacking. Without detailed market studies, states and metropolitan regional governments have little basis for committing funds for ATMS and ATIS other than the results of scattered operational tests and selected information revealed to the public from private sector market research.

> MAJOR FINDING Most Metropolitan Planning Organizations (MPOs) and state and local departments of transportation simply do not have the funding, staff, and expertise to fully detail the benefits and costs of ATMS and ATIS user services.

IV. THE CHICKEN-AND-EGG DILEMMA

A barrier to the deployment of ATMS/ATIS is the classic chicken-and-egg problem. This has initially plagued the deployment of many advanced technological systems.[1] It seems difficult to implement ATIS without ATMS in place to generate the traffic data ATIS requires.

At the same time ATMS will be more effective when:

- ATIS data bases exist;
- The data are disseminated;

[1] For example in the nascent years of the television industry, potential TV viewers would not buy televisions until broadcasting stations were established throughout the country, but no one would invest in broadcast stations until they were confident enough people would buy TV sets. Solving this "chicken-and-egg problem" required a number of things to occur: the allocation of part of the electromagnetic spectrum for TV broadcasting, the setting of technical standards for broadcasting and television receivers, the achievement of economies of scale in manufacturing to lower the price of TV sets. the development of TV programs, and attracting advertising sponsors.

- Consumers have equipment at home, at work, and on the move to receive the information and to change travel choices in a timely fashion.

The availability of ATIS enhances ATMS by aiding in the dissemination of ATMS data, by making additional data from other sources available, and by using the data to create new information useful to consumers. ATIS adds a dimension that makes the data generated by ATMS useful to a broader range of users.

In general, the private sector will not invest in developing ATIS equipment and telecommunications for use at home, businesses, and in vehicles until reasonable positive cash flows are possible. This will require large numbers of consumers. This in turn, is likely only after much of the ATMS system is fully deployed in a significant number of metropolitan areas around the country.

The government and private sector working together may accommodate this problem. If taxpayers are willing, the public sector will implement improved traffic control systems, install ramp meters, changeable message signs, highway advisory radios, and so on. The public sector will have taxpayer support to make these investments faster if the private sector spreads the benefits of advanced traffic management widely through manufacturing the requisite equipment and installing the needed telecommunications systems.[2]

[2] The reader is reminded that there is very little empirical economic data on the costs and benefits of ITS. A fundamental assumption of this study is that ATMS provides to society such benefits as reduced congestion, accidents, pollution, and energy consumption as well as more efficient intermodal connections. We also assume that these benefits will outweigh the total costs to create an ATMS infrastructure. This thesis remains untested empirically.

Government can quickly solve the chicken-and-egg problem by paying for the deployment of the ATMS infrstructure which in turn will provide the traffic data for ATIS.

V. THE IMPORTANCE OF CASH FLOW AND PROJECT FINANCING

The private sector anticipates several possible lines of business that could emerge from ATIS deployment. Various cash flows to support investment are possible under different ATMS and ATIS deployment strategies.

Figure 1 maps qualitatively the cash flows and other benefits that will flow from the deployment of ATMS and ATIS user services.

Figure 1 schematically portrays public and private investment streams. These in turn create public benefits of reduced congestion, accidents, pollution, and energy consumption. At the same time, the information generated is repackaged and sold to consumers, creating cash flows (revenue streams) for value-added telecommunications service resellers, equipment manufacturers, personal communication service providers, and suppliers of computers, software, and telecommunications to homes and businesses.

Government must decide whether to confine its role to capitalizing ATMS (and basic ATIS), or whether to enter into broader, advanced ATIS services. For example, government could form a public/private joint venture that provides ATMS and basic ATIS data to private vendors of advanced ATIS services. It could then require the private vendors to pay the ATMS system for the raw information. Or the ATMS and basic ATIS services could be provided by a private vendor under government aegis, using government funds to capitalize . the infrastructure and, in turn, requiring compensation from information resellers that reuse the information generated.

By making an investment that benefits certain private investors, the government may therefore serve the public interests by making ATMS data more broadly available to the public. If the alternative, based on the economics of a particular project, is that ATMS data will not reach a large portion of the public, this may be the best use of government funding in a particular case.

If ATIS and basic ATIS user services are funded by government and provided as a free good, then all of the revenue flows will accrue to equipment vendors[3] and to the information vendors.[4] This outcome may be appropriate and actually maximize the public and private benefits of deploying ATMS and ATIS.

VI. SEPARATE OR INTEGRATED ATMS AND ATIS SYSTEMS?

Figure 1 suggests interoperability and the exchange of information between ATMS and ATIS systems are important. But close integration of physical infrastructures of ATMS and ATIS is not critical and may actually slow deployment of both.

First, ATIS is not necessarily dependent upon traffic data emanating from the ATMS infrastructure. ATMS may be only one of several sources of information used by ATIS vendors. ATIS could be deployed independently of ATMS, using a variety of private surveillance techniques including the use of probes, aerial and satellite reconnaissance, closed circuit television, transponders, and the application of pattern recognition techniques to gather and link travel time information outside of the ATMS infrastructure.

In the short run private and public surveillance systems may be far more cost effective in gathering information about congestion and travel time than developing a full-blown ATMS.

Evidence is mounting, based in part upon the field operational test in the Boston region, that the private sector can independently deploy ATIS and is not necessarily dependent upon data that emanates from an ATMS in order to provide pre-trip information or even en-route guidance. Companies like SmartRoute Systems, Metro Traffic Control, and Shadow Broadcast Services all use a variety of traffic surveillance techniques (e.g. aerial surveillance, cameras on building rooftops) not tied to data that comes from sensors installed in publicly owned rights-of-way.

This current experience raises a distinct and troubling question. The market for basic ATIS information which an ATMS system can produce may be very limited. It is not proven that basic traffic information produced by ATMS will be distinctly different from data

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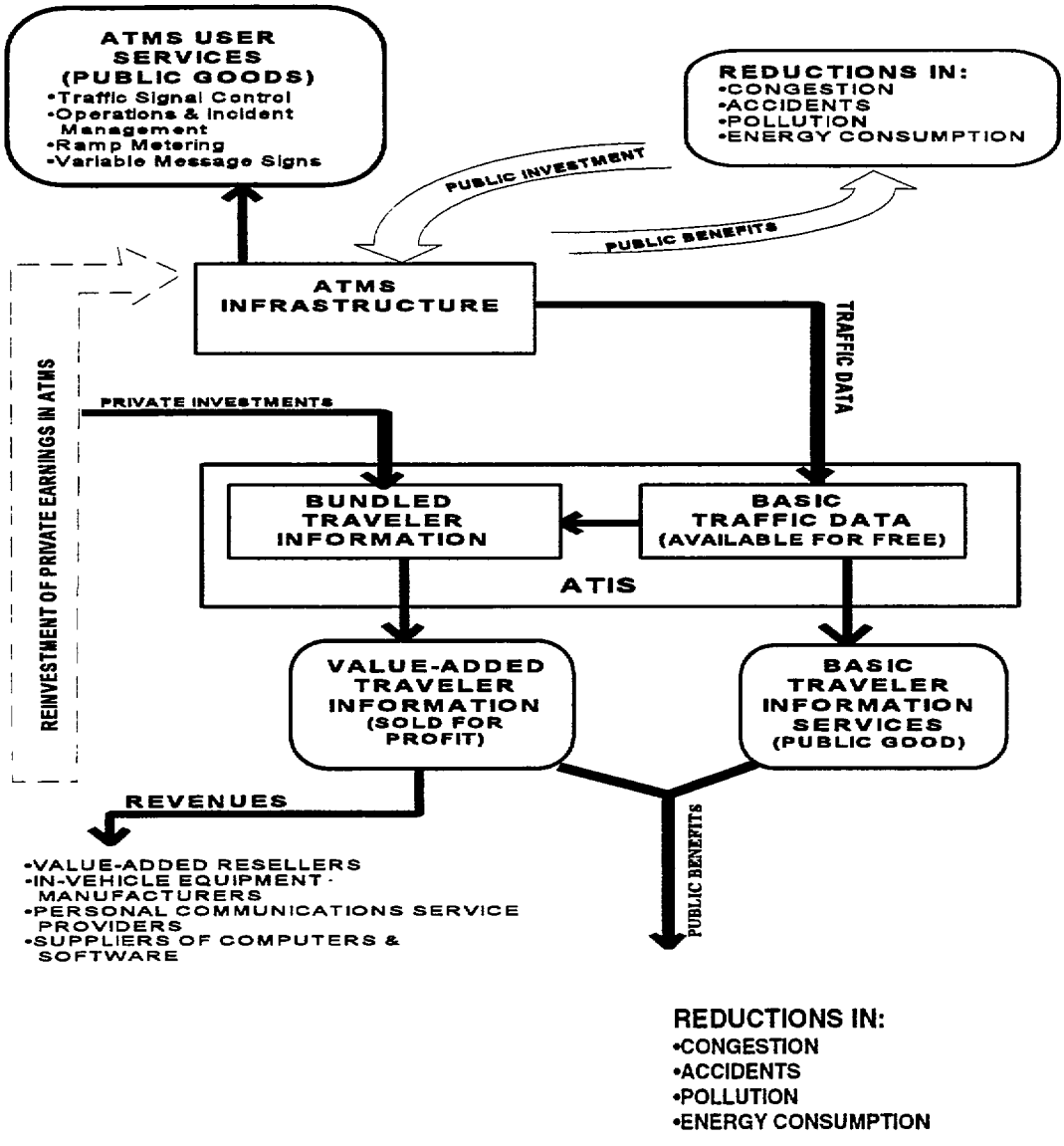
[3] Computers, in-vehicle route guidance equipment, and personal digital assistants, are examples of equipment that could be used to access and handle the ATMS/ATIS information.

[4] Information vendors are entities that sell to end-users value-added information. One possible source is to create user-specific information out of a combination of user profile information and basic ATIS data.

FIGURE 1

REVENUE FLOWS AND OPERATIONAL RELATIONSHIPS IN ATMS/ATIS



that can be gathered independently of any ATMS system. For example, commercial vendors of traffic data today rely on rush-hour airplane surveillance, volunteer cellular telephone reports, cable television remote cameras, and monitoring of police and fire radios. Collating this information, and selling it to commercial radio and television stations to disseminate to the driving public is efficient and prompt. The question is whether ATMS generated data will add much value to this other information already being gathered independently of any ATMS system.

If ATMS generated data is not uniquely valuable, it will not sustain a second ATIS vendor which wishes to challenge the incumbent information vendor in the market. However, there is good reason to assume that basic ATIS data generated by ATMS should be treated as a public good available to all. In this event, even if the market will not sustain two ATIS vendors, the ATMS data will provide less costly data to the dominant vendor.

> In the long run, ATMS is likely to be preferable to independent traffic surveillance systems for providing dynamic information to ATIS services.[5]

An alternative scenario presents itself. ATMS might be less expensive to deploy if it relied on private sector surveillance technologies not located in the rights-of-way. In this event, ATMS would be a customer of the private sector ATIS vendor, rather than the more likely alternative discussed above.

ATMS might prove most cost-effective by using private providers of traffic surveillance information to design, build, operate and maintain traffic signals, ramp meters and so on, rather than the public sector building and operating its own information monitors.

A second reason for implementing separate ATMS and ATIS systems is to divide responsibility between the public and private sectors. ATMS appears to have the characteristics of a public good--once produced it is available to all at no cost.[6] The public sector is the traditional provider of public goods and likely has to deploy ATMS. On the

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[5] ATMS is expected to permit real time. adaptive and integrated control of traffic over a regional network. This will produce massive, and instantaneous information flows that should provide significant advantages in drawing traffic data from ATMS rather than independent traffic surveillance systems.

[6] See Chapter 4 for a detailed description of the economic theory of “public goods” versus “private goods” and the implication for government versus private sector provision.

other hand, economic efficiency argues it is better for the private sector to deploy a private good like ATIS.

Figure 1 suggests the ATIS retained earnings and ATMS user equipment economic rents could potentially be reinvested in expanding ATMS. However, this will only occur if the private sector can profit from joint participation in both ATMS and ATIS, and the whole operation is profitable.

> RECOMMENDATION: ATMS and ATIS should be closely coordinated in deployment planning, Efficient and easy data transfer from ATMS to ATIS, and back, will expand the geographic coverage. and market penetration of both ATMS and ATIS user services. Close coordination including possible integration will support and encourage the potential to share revenues earned from ATIS and ATMS.

VII. PRIVATE SECTOR ROLE

1. The private sector will best identify and capitalize on the market opportunities related to traveler information services. It will develop effective ways of communicating traveler information services.

> RECOMMENDATION: At a minimum, the private sector should provide value added ATIS user service, possibly including ATIS basic services.

2. Government can contract with the private sector for professional services and to supply equipment and telecommunications.

3. The more government structures ATMS and ATIS as a private sector opportunity, the more the private sector role will expand and the level of public investment be reduced. However, there are risks of non-deployment if the private sector is asked to provide public goods that cannot be repaid by the market.

4. Private sector involvement requires:

- Sufficient revenue streams from service or equipment sales to pay for investment and operating expenses;
- A higher than normal return on the private goods to pay for the public

good infrastructure providing public goods for free;'

- Defined responsibilities between public and private sector activity to limit financial risks;

- Policy stability to recover the life cycle investment costs of the projects.

5. There are additional major obstacles to the private sector building and operating ATMS:

   - Access to publicly-owned and managed rights-of-way where traffic control equipment is placed;

   - Permission from government to manage traffic, which is government's responsibility under law;

   - The complex and costly challenges of achieving the multiple jurisdiction cooperation required to implement ATMS;

   - Resistance in many localities to implement ATMS quickly.'

In the ideal world, deployment of ATMS and ATIS will use the least possible investment, the lowest operating expenses, and generate the greatest social benefits in both public and private goods. This argues that a balance between public and private provision is likely to be best, assuming there are true public goods available from ITS. The line between public and private provision should be drawn at the point of departure between public goods and private goods.

Unfortunately, the world is not ideal. It is impossible to predict exactly what goods will be produced by ATMS and ATIS, which will be public and which private, and how valuable they will be to the society. As a result, the study concludes:

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[7] For example, private vendors of ATIS services may ask for rights to exclusivity and protection from competitive entry if they are expected to subsidize the ATMS infrastructure investment.

[8] Communities list several reasons for going slow. These include fear that thoroughfare traffic will be routed through neighborhoods and local streets; higher priorities for pavement-related work than for operational improvements; lack of funds and staff to maintain and operate new systems once they are built; a general preference for home versus metropolitan rule; and the lack of legal authority to delegate traffic control responsibilities to a regional organization.

FUNDAMENTAL RECOMMENDATION: Use multiple test beds for deployment that will examine the full range of possible public/private provision combinations. To the extent the systems generate public goods, look for government provision, whether direct or through contract agents. To the extent the systems generate private goods, look for private provision with the broadest possible competitive entry. Where competition is not feasible due to economies of scale or limited revenue potential, look to regulation of the activities of the private vendor. Where there is a mix of public and private goods, look to institutional arrangements that foster joint provision by the public and private sectors.

VIII. INSTITUTIONAL BARRIERS TO ATMS AND ATIS DEPLOYMENT

A major task of the study was to examine the histories of the national deployment of other technologies to identify institutional barriers possibly relevant to ITS. The study looked at a whole series of technologies, from telecommunications to environmental. The technologies selected had several common characteristics:

- The introduction of a new technology;
- The technology addressed a broad social need or demand: and
- The government played a significant deployment role through stimulation, operation, subsidization, or regulation.

A. Each of the technologies discussed in the report illustrates one or more of the following lessons:

1. Standards are a two-edged sword.
   - Early implementation accelerates market penetration.
   - But early "closed" standards retard competition and technological innovation.
2. Government regulation requires both adequate authority and adequate implementation to be effective.

3. Subsidies will stimulate development. But once started, subsidies are hard to terminate.

4. Government can force internalization of social costs.

   Government will seek to attain social welfare goals, as well as, economic efficiency (i.e., least cost). Sometimes there is a trade-off between social welfare and economic efficiency. Other times, there is a positive gain in both accounts.

5. Normal market sale and auction mechanisms do work as devices to allocate public property for private use.

6. Public goods are best delivered as government services.

   The full long term benefit is realized and available to all. The government tax mechanism allows the burden to be spread evenly throughout the society.

B. Overall, the following institutional barriers must be addressed:

1. Potential cash flow/return on investment will define the level of risk, private investment, and community requirements to place on the private operator.

2. Government intervention often leads to unintended results.

   - Be cautious in seeking to create incentives or influence the behavior of private firms or markets.
   - Intervene in increments.
   - Build in fall-back positions.
   - Have an exit strategy from the beginning.

3. Franchising is effective for granting use of public property in exchange for public service obligations.

   - Limit the scope of public concessions granted to the minimum required to permit needed cash flow.
   - Build in sunset provisions, policy transitions, and exit strategies.

- Balance conflicting societal and economic interests in advance.

4. Innovation is stimulated by competition, not regulation.

   - Look for strategies to weaken economies of scale.

   - Where strong economies of scale exist, act strongly to control monopoly behavior.

5. This is complicated policy, difficult to implement.

   - Have complete "models" for the most promising institutional approaches for local communities and regional agencies so they do not have to start over with each project.

   - Avoid sacrificing long term interests for short term budgetary convenience. Limited short term benefits may not warrant long term costs (i.e., free ATIS service to schools is not a fair exchange for a long term monopoly grant).

IX. MODELS FOR DEPLOYMENT

The study describes the full spectrum of possible approaches to deployment for ATMS and ATIS. The models involve varying degrees of public and private participation. The study describes models suitable for building operational systems, as well as, pre-deployment possibilities. Most of the models are not mutually exclusive and can be "mixed and matched." However, certain models appear most likely to foster early and effective deployment.

Assuming ATMS systems will produce largely free public goods, the following models are most relevant for deployment:

- Pure public provision;

- Public owner-builder:

- Standard low bid contracting;

- Lifecycle contracting;

- Performance contracting;

- Public turnkey (including Build-Transfer-Operate and Build-Operate-Transfer); and

- System manager.

The analysis suggests that the most robust model for deployment of ATMS infrastructure is public ownership and operation. This is based on the work to date which suggests most of the products of ATMS will be pure public goods that cannot be priced or reimbursed through consumer user charges. To the extent that ATIS vendors are willing to attach high value to the information produced by ATMS systems, this conclusion is moderated. In that case, private vendors may be willing to build and operate the ATMS systems to gain market exclusivity to the ATMS data.

The opposite conclusion applies to ATIS. The most robust model appears to be pure private ownership, possibly under a franchise, for access to the ATMS generated basic ATIS data. The lack of economies of scale and the dynamic consumer requirements for multiple permutations of useful information suggest ATIS is best provided in a competitive, private sector. setting. Assuming ATIS user services consist of purely private goods and there are no significant economies of scale or access to rights-of-way required, the following models are most relevant:

- Private competition;

- Private owner-builder;

- Private turnkey; and

- Licensing.

If ATMS or ATIS requires rights-of-way access, or has significant economies of scale in the production of information or databases, then the following models, possibly in conjunction with auctions, are best:

- Public franchise;

- Concession (with features similar to a franchise);

- Leasing in various forms;

- Competitive joint ventures[9] and
- Business franchises.

X. RECOMMENDATIONS

The study concludes with a series of general recommendations for the Federal Highway Administration, ITS America, States, and MPOs to consider.

RECOMMENDATION #l: Generally ATMS should be publicly provided, except as noted below. Public provision requires adequate financing structures based upon taxpayer willingness-to-pay. ATMS must also receive high priority relative to competing projects of all types. Generally, the private sector should be encouraged to deploy and profit from ATIS, assuming consumer willingness-to-pay. Furthermore, the private sector should be encouraged and allowed to profit from deployment of integrated ATIS and ATMS if revenues from the combined systems are sufficient to earn a profit while at the same time permitting continual reinvestment and expansion in the ATMS/ATIS or because the public sector provides funds to make up the difference when the costs plus a reasonable return on private investment exceed the revenues.

RECOMMENDATION #2: Joint public and private sector cooperation is important. There is a wide range of worthy institutional models for both ATMS and ATIS. While FHWA should encourage diversity and experimentation, its primary focus must be on the institutional approaches most conducive to deployment.

[9] Competitive Joint Ventures are discussed in Chapter 4. In essence, a group of firms form a partnership to own and operate shares of an underlying natural monopoly infrastructure. The firms then compete openly with each other in using their shares to offer services carried over that infrastructure. The real-world example that comes closest to a competitive joint venture is the "undivided interest" structure of some crude oil pipelines. Each pipeline is jointly owned by several companies which independently post prices and transport oil for other parties. The fixed costs of the pipeline are paid by the owners in proportion to their ownership shares which define the amount of pipeline capacity that each owner may use to provide transportation services. Variable costs of transportation are paid by the owners according to the amount they actually use their capacity.

RECOMMENDATION #3: FHWA should complete the model franchising package by preparing:

- Model state and local authorizing legislation;
- Model Joint Powers Authority:
- Model RFI package;
- Model RFP package;
- Model procedure for assessing risk and determining compensation; and
- Model evaluation criteria.

RECOMMENDATION #4: FHWA should develop model agreements for other institutional structures.

RECOMMENDATION #5: FHWA should move toward deployment demonstrations using the following as the most suitable models:

- Purely public ownership and provision of ATMS and basic ATIS;
- Franchising, both exclusive and competitive, of private sector providers of ATMS and/or ATIS;
- Competitive joint ventures among multiple private parties engaged in common provision of ATMS and competitive provision of ATIS;
- Intermediaries such as non-profit corporations or other organizations (e.g. Help Inc., MPOs, ITS America Chapters) that serve as umbrellas for cooperative undertakings by both the public and private sectors;
- System manager by a private vendor under competitive bid awarded by the public owner of the ATMS system;
- Exclusively private competition offering ATMS and ATIS services; and
- Open Solicitation of a public/private joint venture of an ATMS/ATIS system.

The need for continued public/private sector cooperation is evident in the scope of unknowns still facing ATMS/ATIS deployment. The Study recommends FHWA and ITS AMERICA coordinate further on the following topics:

- The costs and economies of scale of ATMS systems and ATIS systems;
- The vulnerability of particular deployment strategies to short run gamesmanship putting at risk long run benefits;
- The federal role in standardization; and
- Study of taxpayer and consumer willingness-to-pay for ATMS and ATIS.

CHAPTER 1

OVERVIEW OF DEPLOYMENT BARRIERS

A. INTRODUCTION

1. STUDY DELIVERABLES.

The products of this study have received intensive review by many of the country's leading experts on ITS institutional issues. Two symposia were held during this project to review and discuss the task reports and to provide guidance in the preparation of this final report.

The task reports upon which this final report is based are available as appendices:

- Task A Report. Institutional Barriers to the Deployment of ATMS and ATIS (Appendix A)
- Task B Report. Lessons from Other Technologies (Appendix B)
- Task C Report. Models of Public and Private Participation (Appendix C)
- Task D Report. Symposium -- Review of Task A, B and C Reports (Appendix D)
- Task E Report. Analysis of Franchises and License Agreements for the Provision of Public Services (Appendix E)
- Task F Report. Model Franchise Agreements for ATMS and ATIS (Appendix F)
- Task G Report. Symposium -- Review of Task E and F Reports (Appendix G)

2. TASK A SUMMARY.

Task A of the Study examined the institutional barriers to deployment of both Advanced Traffic Management Systems ("ATMS") and Advanced Traffic Information Systems ("ATIS").

ATMS and ATIS both are examples of Intelligent Transportation Systems ("ITS").[10] However, there are significant differences between ATMS and ATIS systems and networks. ATMS generally refers to technology and infrastructure located in or adjacent to traffic routes to improve the operation of the routes on the network and of the control mechanisms for managing traffic flows. ATIS, on the other hand, refers to information systems providing data for planning trips and to the vehicles or the controllers of the vehicles to improve their decision-making and efficiency of vehicle operation. To illustrate, a system to manage urban traffic lights and a system to manage airplanes staging for landing at an airport are examples of ATMS. A system which communicates preferred routing to drivers during rush-hour, and a system providing instructions to a tanker at sea to head to another port-of-call to take advantage of a slight shift in spot market oil prices are examples of ATIS.

The significant distinctions between the applications of ATIS and ATMS compel separate analyses. Each presents separate market introduction problems because the potential user community (the city traffic manager for ATMS and the rush-hour driver for ATIS) dictates the demand for the service and the potential revenue stream available to pay the capital and operating costs.

> Major Point: ATMS and ATIS will experience differenct revenue potential.

At the same time, both ATMS and ATIS share several entry problems. For example, particular ATMS and ATIS architectures may both require road-side equipment necessitating affirmative authority from the local government to occupy the public rights-of-way.

Task A relied on extensive literature research, expert interviews, and some independent analysis. It presented its findings and conclusions in five cluster groups: public sector issues; financial constraints to deployment; public/private sector issues; consumer issues; and societal issues.

Intelligent Vehicular Highway Systems ("IVHS") is an out-of-date generic term originally intended to describe a wide range of technologies intended to improve the economic, environmental, and social efficiency of highway and rubber-wheeled transportation. Now there is common recognition that all transportation needs and requirements should be viewed on a multi-modal and intermodal basis. Assumptions that only streets and highways will benefit from improved management and information systems are self-evidently false. As a result, the term Intelligent Transportation Systems ("ITS") is preferred and will be used throughout this report.

B. PUBLIC SECTOR CONSTRAINTS

Metropolitan area or regional planning organizations (MPO) are logical focal points for ITS implementation. Most transportation problems are regional in character and require regional coordination to resolve: The new federal intermodal surface transportation legislation (ISTEA),[11] provides substantial authority to these planning organizations to review federally funded transportation projects in the region.

An obvious constraint on ITS is the lack of staff and funds currently available to the MPOs. This means most MPOs will find it difficult to study and innovate ITS projects as they develop transportation plans. Nevertheless, MPOs hold great promise as the leading source of expertise to serve as intermediaries between public and private entities to develop various deployment models for ITS. In particular, MPOs need to familiarize themselves with the elements of franchising and the flexibility it can give to ITS deployment.

Major Point:	MPOs are central to the deployment of ITS. But MPOs are poorly staffed for the task.
Major Point:	Local jurisdictions must cooperate and yield authority to MPOs to implement region-wide ITS.
Major Point:	Need for MPOs to study franchising and other models and their flexibility for deploying ITS,

Additional constraints are the inability to integrate management and monitoring systems. There is a wide range of new systems being installed for managing congestion, safety, pavement repair, bridges, intermodal facilities, and public transit. Practically none of these projects are coordinated between each other or approached as an overall transportation system integration problem. Another problem is the multi-tiered contracting responsibility between different levels of government.

Local elected officials remain unconvinced that advanced technology systems will improve traffic operations enough to divert scarce funds from highway construction, pavement rehabilitation, transit operating subsidies, and low-tech solutions to traffic management. Until elected officials decide that ATMS and ATIS projects must be included in state and metropolitan Transportation Improvement Programs (TIPs), ITS projects will not be implemented.

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11 Intermodal Surface Transportation Efficiency Act of 1991, 10.5 Stat. 1914, 49 U.S.C. § 101 *et seq.*

C. FINANCIAL CONSTRAINTS

There are many factors that impose financial constraints on the development of ITS systems. These factors include the need to establish a revenue stream that will reward and encourage investment, initial costs of development, and the need to develop an initial mass of users large enough to support the growth of the system, also known as the "chicken-and-egg dilemma.

1. Need for an Adequate Revenue Stream.

Somebody has to pay real money to build ITS systems and networks and to install user equipment. This investment must be repaid if it is to be replicated around the nation.

In a free-market capitalist economy, investments are made on the expectation of repayment with reasonable return on the investment. Private investors must have an anticipated future revenue stream, either from services to be sold to end-users, or from government subsidies. Public entities may instead make the investment, but again the political process will expect a social benefit greater than the economic value of the resources committed to the project.

Organizing ITS projects to repay the capital and operating costs is the central constraint on deployment. Solving this problem is the central solution to rapid deployment of all ITS. We discuss this problem in detail in Chapter 4 and propose specific approaches to its solution.

Major Point: Organizing ITS projects to repay the capital and operating costs is the central constraint on deployment.

A great amount of high value traffic data used in ATIS will likely come from publicly funded ATMS. But it will be difficult to convert this value into a revenue stream that can be used to cover ATMS costs. There are several reasons. Many government agencies are loathe to charge for traffic data when taxes and road user charges paid for the traffic management system that generates the traffic data.[12] Strong protests to any system of charges are likely from many quarters, including the private entities seeking to sell value-added traveler information services. Firms in the business of selling traveler information for a profit have strong incentives to obtain basic traffic data for free. And taxpayers may believe they are

12 The recent appearance of various forms of user fees for government provided services suggests government officials may be more open-minded about assessing charges to the users of traffic data to repay the general taxpayer investment.

paying twice -- once through taxes and again through user charges. This compounds the difficulty. .

Public concerns about equity and universal access to basic communication services reinforces the idea that traffic data generated with public funds should be available for free or very low cost to all segments of the population.[13] But if basic ATIS service (information on travel time and costs by mode, route and time of day) is free or nearly so, then the only potential source of private sector revenues to cover ATMS and ATIS system costs are value-added services -- imposing the cost of ATMS/ATIS on relatively few businesses and a limited percentage of the population.

> Recently Congress has debated access of low income people to the national information superhighway. These concerns with equity, access, and fair distribution of the benefits of. technological systems spill over to the ITS arena

Another argument for free or very low cost basic ATIS service is expansion of the potential market for in-vehicle navigation and routing equipment. Expanding this equipment market may create conditions conducive to economies of scale in manufacturing. The lower the unit cost of manufacturing, the lower the price to consumers. Below a price barrier the market takes off and deployment dramatically accelerates, as the history of the computer, cellular telephone, Satellite Global Positioning System (GPS) receivers, TV, and other industries attest.

The availability of free or very low cost traffic data helps stimulate the sale of ATIS equipment, allowing consumers to make better travel choices, reducing travel time, accidents, pollution, and energy consumption.

> Free basic ATIS services tends to maximize public benefits, but inhibits cost recovery and may make full deployment of ATIS and ATMS economically infeasible.

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13 Historically, the Federal Communications Commission and state regulators have fostered a policy of universal access to basic communications services at an affordable price. Thus there is a flat monthly charge for basic local telephone service. The same concern is manifest in the history of the electric power industry, particularly rural electrification. Although ATIS information is not, and will not be ubiquitous, its utility will grow the more it is available to all the vehicles in the transportation network,

2. Effects of Taxpayer and Consumer Willingness to Pay.

Government will naturally concentrate on putting the ATMS infrastructure in place. It is likely to leave deployment of ATIS up to the private sector. ATMS user services, with the exception of electronic toll collection, tend to be "public goods," meaning that once provided to a single consumer, they are free to all and the consumption by one does not diminish the consumption by another. Consumers have no need to pay to receive the service. As a result, market pricing mechanisms do not work. Therefore these services are not likely to generate revenues, a major barrier to the private sector deploying ATMS.

The ability of the public sector to deploy ATMS depends ultimately upon taxpayers' willingness-to-pay, unless there is cross-subsidization from selling ATIS user services or other products and services. A substantial unknown at present is what, if any, market can develop for ATIS services. Presumably ATIS service providers will create added value to traffic information generated by ATMS infrastructure, repackage that data and sell it to end-user consumers, such as trucking companies and commuters seeking least-cost or least-time routing information. The actual market value of this data remains to be proven. To the extent ATIS does produce marketable information capable of generating substantial cash flows, then ATIS providers may be a possible and appropriate source of revenue to underwrite some or all of the costs of ATMS. Another possible source of money to support ATMS could be services which derive value from the public ownership and control of rights-of-way (e.g. the selling of "dark" fiber in conduit beneath the roadway surface to telecommunications companies seeking additional transmission capacity). Cross-subsidy is only possible where buyers are willing to pay both the cost of the revenue generating services, plus enough to cover part or all of the ATMS costs.

> MAJOR FINDING: There is no greater obstacle to the deployment of ATMS and ATIS thanlack of data on taxpayer and consumer willingness to pay for ATMS and ATIS user service

Publicly available market research on the willingness of taxpayers and consumers to pay is woefully lacking. Without detailed market studies, states and metropolitan region governments have little basis for committing funds for ATMS and ATIS other than the results of scattered operational tests and selected information revealed to the public from private sector market research.

> MAJOR FINDING: Most Metropolitan Planning Organizations (MPOs) and state and local departments of transportation simply do not have the funding, staff, and expertise to fully detail the benefits and costs of ATMS and ATIS user services.

3. Promoting Private Sector Investment: The Chicken-and-Egg Dilemma.

A barrier to the deployment of ATMS/ATIS is the classic chicken-and-egg problem. This has initially plagued the deployment of many advanced technological systems.[14] It seems difficult to implement ATIS without ATMS in place to generate the traffic data ATIS requires.

At the same time ATMS will be most effective when:

- ATIS data bases exist;
- The data is disseminated; and
- Consumers have equipment at home, at work, and on the move to receive the information and to change travel choices in a timely fashion.

In general, the private sector will not invest in developing ATIS equipment and telecommunications for use at home, businesses, and in vehicles until reasonable positive cash flows are possible. This will require large numbers of consumers. The more ATMS systems are deployed throughout the country, the more likely this will be.

The government and private sector working together may accommodate this problem. If taxpayers are willing, the public sector will implement improved traffic control systems, install ramp meters, changeable message signs, highway advisory radios, and so on. The public sector will have taxpayer support to make these investments faster if the private sector spreads the benefits of advanced traffic management widely through manufacturing the requisite equipment and installing the needed telecommunications systems.[15]

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[14] For example in the nascent years of the television industry, potential TV viewers would not buy televisions until broadcasting stations were established throughout the country, but no one would invest in broadcast stations until they were confident enough people would buy TV sets. Solving this "chicken-and-egg problem" required a number of things to occur: the allocation of part of the electromagnetic spectrum for TV broadcasting, the setting of technical standards for broadcasting and television receivers. the achievement of economies of scale in manufacturing to lower the price of TV sets, the development of TV programs, and attracting advertising sponsors.

[15] The reader is reminded that there is very little empirical economic data on the costs and benefits of ITS. A fundamental assumption of this study is that ATMS benefits to the society in the form of reduced congestion, minimized highway construction, increased productivity through shorter average travel times, and more efficient intermodal connections outweighing the total costs to create an ATMS infrastructure. This thesis remains untested empirically.

Government can quickly solve the chicken-and-egg problem by paying for the deployment of the ATMS infrastructure which in turn will provide the traffic data for ATIS.

D. PUBLIC/PRIVATE SECTOR CONSTRAINTS

Task A reviewed the general set of relationships between government and private individuals and entities. Aside from the economic marketplace problems described in detail in Chapter 4, the Task A Report identified the following important deployment constraints.

1. What Price ATMS and Basic ATIS Services Will Cost?

Basic ATIS services will likely be free.

As discussed above, in most deployments, government is likely to conclude ATIS basic services should be available at little or no cost. The taxpayer has already paid the bill for building the ATMS infrastructure. Charging for the data risks social inequities as certain users of transportation systems receive information solely because they can afford to pay for it. And the broader social benefits of less congestion and pollution will be lost unless the traffic information is available to all drivers on the road.

The broader the category of free services, the more public funding will be required.

There is a need to define the scope of any free basic service. Any free services severely limits the ability of the ATIS services to pay for the overall investment.

In the long run, private provision of ATMS and basic ATIS is likely to be more costly to both the public and private sector.

The Task A Report reaches this conclusion after looking at the prospective investment horizons for private sector industries in high technology areas. The private sector has great difficulty capitalizing any economic activity that cannot produce a positive rate of return within a five to seven year period. This is the result of internalizing project risk in the form of future inflation and market uncertainties. Together, these generate a required internal rate of return (a "hurdle rate" to investors) that is prohibitive for long term projects dependent on new technologies with uncertain consumer demand.

The Task A Report states this phenomenon will force private investors in ATMS to look only to markets where the vendor can monopolize the information produced and resell it at rates that warrant the ATMS and ATIS combined investment. The potential investor will focus naturally on only the highest density regions with medium to long term protection from

competition. Together, these conditions will result in a partial, expensive, short-term deployment strategy that will never realize the full positive externalities possible from fully deployed ATMS systems.

2. Contracting and Procurement.

Traditional government procurement is a poor match to ITS technology. ITS will require innovative new partnership relationships between government and the private sector. Traditional procurement is cumbersome and inconsistent when multiple jurisdictions try to cooperate in a common project. Procurement procedures, conflict of interest concerns, and "sunshine in government" regulations may restrict the degree of cooperation between public and private entities in a joint proprietary activity.[16]

3. Opposition from Competitors.

Established transportation modes will oppose new programs intended to improve the operation of competitive transportation modes. This opposition can be minimized if the multi-modal aspect of ITS is emphasized, producing relatively equitable productivity gains to all transportation modes.

4. Unresolved Legal Questions.

Legal uncertainty discourages investment. The risk of adverse legal outcomes, uncertain contractual obligations, or unpredictable damage claims greatly change the rates of return on investment required to finance a project.

Unfortunately, ITS is loaded with a series of legal unknowns that are certain to discourage early innovators. Some examples:

- What tort liability does a private ITS operator face if equipment it operates causes a major traffic catastrophe?
- Who owns the intellectual property rights to the information generated by an ATMS system designed and operated by a private entity under contract to an MPO?
- Do the antitrust laws apply to a public/private partnership operating an exclusive ATIS system under a grant from the local government?

[16] The effect of public disclosure laws is a matter of some debate. While the public sector generally argues that such laws ensure public support for worthwhile projects, the private sector often expresses concern over the disclosure of proprietary information. which may inhibit some participants, thus restricting the range of bidders and projects.

- Will all necessary federal communications licenses be available for the useful life of the system?

Major Point: There is need for a comprehensive body of law, either legislation or regulation, to resolve the legal status of ITS and remove unnecessary legal uncertainties.

5. Technical Standards.

Adoption of communication protocols and other standards for ITS is widely believed necessary. But there is good reason to go slow. Standards can create a market by allowing manufacturers to concur on common inter-operability criteria, allowing multiple types of equipment to address an identified consumer need." But standards can retard innovation and competition and tend to favor incumbent producers.'* Fortunately, recent innovations in radio transmission technologies suggest that new equipment can be manufactured with multiple standard compatibility. This drive toward "open standards" should encourage competition while allowing inter-operability between systems and networks of different "generations" of technology.

E. CONSUMER ISSUES

The dominant unknown is how much consumers will pay for ITS services. There are no adequate demand studies testing consumer demand. And many of the benefits from ITS may not be susceptible to market pricing at all. More on this in Chapter 4.

F. SOCIETAL ISSUES

Another constraint on ITS is privacy concerns. The technology allows, and even requires, massive accumulation of citizen-specific data. This data is acquired through surveillance technologies that could be applied to law enforcement as well as to ITS

17 Examples include television transmission standards and facsimile machine transmission standards which permit multiple manufacturers to compete.

18 Recent European cellular radio standards illustrate the risk. The Europeans adopted a digital transmission standard that will permanently limit the number of operators to two in each market. By contrast, the new U.S. digital cellular standard appears to tolerate a large number of operators.

management. The public will require reassurance and protection against unauthorized use and misuse of personally identifiable data.[19]

A further political constraint may emerge if ITS is not available equitably throughout the society. It is one problem for a commuter stuck in traffic to see van pools and HOV autos zipping by in a reserved lane. It is a more serious political problem if the reserved lane is serving only Mercedes, Lexus, and Cadillacs because the in-vehicle equipment is too expensive for most households.

[19] A useful precedent has been set in the cable television field. The federal Cable Act specifically provides that any personally identifiable information acquired by a cable operator on its subscribers may not be disclosed without the subscriber's permission or a court order. 47 U.S.C. § 551 (1995).

CHAPTER 2

LESSONS FROM OTHER TECHNOLOGIES

> Experience is a wonderful thing--it helps us to recognize a mistake when we make it again.

A. INTRODUCTION

ITS is new and revolutionary. It is revolutionary in the application, not in the underlying technologies. ATMS and ATIS will use existing telecommunications and sensor technologies in a new application. The underlying equipment will come directly from telephone, cable television, satellite, and cellular radio equipment vendors. In each of these technologies, the federal government played an essential role in development and deployment.

The Task B Report suggests that ITS deployment strategies have much to learn from pre-existing technologies. The Task Report examines selected previous experiences to test for relevant "lessons learned" to apply to ITS.[20] The areas selected have several common characteristics:

- The introduction of a new technology;
- The technology addressed a broad social need or demand; and
- The government played a significant deployment role through stimulation, operation, subsidization, or regulation.

This Chapter outlines the significant conclusions of that report.

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[20] No history is complete, or totally unbiased. The art of history is to select those facts that are causal to the eventual outcome. Since the historian knows the outcome, but can never know all the facts, historical conclusions should be read skeptically. The reader is advised to view the study's conclusions skeptically as well. While the authors defend the analysis as sound, and believe the lessons learned are real, there are other experts in each of the technologies who may well argue different facts and conclusions.

B. TECHNOLOGIES REVIEWED

The Task B Report examined the history of each of the following technologies:

- Cable television
- Direct broadcast satellite ("DBS")
- High Definition Television ("HDTV")
- Cellular Telephone
- Telephone
- Geographic information systems ("GIS")
- Satellite global positioning systems ("GPS")
- Electric power generation
- Water supply
- Refuse collection
- Electronic funds transfer
- U.S. Weather Service
- Information services

C. GOVERNMENT INTERVENTION IN ECONOMIC ACTIVITIES

The federal government played a significant role in each of the technologies studied. Usually, the government intervened strongly and with a purpose. The parallels to the federal government seeking to encourage the deployment of ATMS/ATIS are obvious. The question presented is why did the government intervene? And is it relevant to the future of ATMS/ATIS?

THEOREM: Government intervenes in an economic sector under predictable conditions.

1. Conditions for Intervention.

A close reading of the history of each of the listed technologies proves the general rule of economics that government acts to correct economic market imperfections--however, those are defined by the political system. In the United States, a strong societal consensus opposes government intrusion in normal business activities. The role of government has been confined to actions that fall into one or more of the following categories.

Conditions for Government Intervention:

- To create favorable market conditions and to police "fair" business practices;
- To correct market failures;
- To give the public fair value for public property.

The following anecdotes, many from the Task B Report, illustrate the above rule of governmental economic intervention. Each is used to illustrate a basic lesson applicable to ITS deployment strategy.

2. Government Can Create a Market.

A. Standard Setting.

Television Receiver Standards--The FCC successfully created a nationwide market for the infant television industry by selecting a particular transmission standard. TV set manufacturers immediately went to market with confidence their sets would work in every TV market in the U.S. Europe adopted a different standard, primarily to prevent U.S. manufacturers from dominating the European market.

AM Stereo Radio Standards--In the 1980's, the Reagan-era FCC refused to adopt an AM stereo standard, declaring the market should decide between the two competing, but technically incompatible standards. The decision slowed market penetration of AM stereo by ten years or so and forced the manufacture of radios capable of receiving either signal. This made the radios more expensive. The delay effectively killed the AM broadcast service as a real competitor to FM stereo.

But consider the examples of High Definition Television (HDTV) and cellular telephone:

Japan adopted a HDTV analog standard several years ago to try to preempt the US TV market. US broadcasters refused to invest in the Japanese transmission technology until the FCC allocated additional spectrum to each station to support the new service. Also, U.S. broadcasters anticipated a superior digital HDTV standard would develop in a few years. As a result, no US market for Japanese HDTV sets has developed. And the US TV industry is now poised to implement spectrum efficient digital HDTV service that will not interfere with older analog TV set reception.

The FCC adopted an analog cellular telephone frequency allocation which prevents more than two analog operators in any market. This duopoly model allowed the cellular industry to develop quickly, with the expectation of large duopoly profits. But consumers continue to pay monopolistic prices as the two operators refuse to engage in price competition.

LESSON LEARNED Standards are a two-edged sword.

Early implementation accelerates market penetration.
But early "closed" standards retard competition and technological innovation.

B. Controlling Anti-Competitive Behavior.

The electrical power industry was forced to segregate itself into three sectors: generation, long distance transmission, and local distribution. This allowed the introduction of competition into the generation segment of the industry while the distribution and transmission portions remain largely monopolistic. And even that is rapidly changing now. Competition in generation reduced the need for federal price regulation and substantially reduced costs to consumers.

The FCC has enforced rules since 1978 to assure competitive long distance telephone companies receive reasonable treatment and prices when they interconnect with monopoly local telephone companies. As a result, long distance has seen remarkable competition and long distance rates have declined every year since the introduction of competition.

Congress ordered cable television operators that control channels of programming to make those programs available under reasonable prices to the Direct Broadcast Satellite ("DBS") industry which could not compete with cable television unless it had comparable programming. Today DBS is growing as fast as its manufacturing facilities for customer receivers can operate.

But consider the 1982 ATT divestiture:

The 1982 divesture of the Bell Operating Companies from ATT prohibited the Bells from offering information services beyond local telephone territories. The Justice Department feared the Bells would use local telephone monopoly profits to cross-subsidize and destroy infant competitors in the database/information service business. The prohibition prevented the Bells from implementing the full capabilities of new switching and transmission technologies, such as SS-7 switches which offered the ability to separate management and control of calls from the calls themselves. The same applies to the Integrated Switched Digital Network (ISDN) transmission technology that became widely available in the late 1980's. But it was most useful for computer-to-computer communications and the Bells had no real economic incentive to expand the market.

LESSON LEARNED: Structural separation of monopoly from competitive lines of business may prevent cross-subsidies,

But a prohibition on the monopoly infrastructure provider from entering competitive lines of business in a multi-product service market must be weighed against the possibility of delaying the enhancement of the underlying infrastructure.

3. Government Can Compensate for Market Failures.

A. Restraints on Monopoly pricing power.

The FCC imposed telephone price cap regulation in the mid-1980's to replace rate-of-return regulation. Price caps were applied to monopoly service prices and non-monopoly services were released from regulation. This allowed the telephone industry to price new competitive services at market levels, while restricting monopoly service prices to their historical levels, adjusted for inflation and productivity gains. The telephone industry today has the strongest revenues ever, while traditional monopoly telephone service charges have remained stable.

B. Government Can Create Incentives Not Otherwise Present in the Market.

The New Deal included the Rural Electrification Program (REA) to stimulate rural electric and telephone expansion. The program depended on a system of government loans and loan guarantees. By 1970, all of rural America was wired.

Another example is 911 telephone service. Local governments paid the telephone industry to implement 9 11 service. Today, those government subsidies have allowed the service to develop universally throughout the country.

But consider the REA program: The program today continues because it has a large constituency of rural companies that refuse to relinquish their rights to cheap government loans.

LESSON LEARNED:	Subsidies will stimulate development. But once started, subsidies are hard to terminate.

C. Government Can Force Internalization of External Costs.

Many businesses reduce their costs by avoiding, or "externalizing", the full consequences of their activities. The classic example is a company producing air pollution which imposes a cost on the nearby residents in the form of impaired health. This cost could be internalized by compelling the company to pay the health care costs and lost income of the injured neighbors. The company would then voluntarily install stack scrubbers as a cheaper alternative. Often, government regulation forces a form of internalization of these external costs.

For example, EPA forces solid waste disposal companies to deal with hazardous wastes. These costs are passed along to the creator of the waste and eventually costs are passed back to the manufactured product generating the waste.

Another example exists in the television industry. The FCC requires television broadcasters, as a condition of federal licenses, to act as "public trustees" and to program in the interests of their communities of license. This generates more political and public affairs coverage than would exist under an unregulated regime.

A third example is the national telephone network. State and federal regulators require reliability and network design standards in the telephone network. Left alone, the telephone company would likely build a system with much lower reliability characteristics than the existing system. By contrast, the cable television industry had few, if any, reliability requirements. Most consumers can attest to the contrasting reliabilities of the telephone and cable networks.

But consider the effects of content regulation:

The broadcast industry is less innovative and outspoken because of the threat of FCC review. Lawyers and First Amendment scholars argue that FCC content regulation has discouraged innovation and sharp-edged political commentary.

LESSON LEARNED: Government can force internalization of social costs. Government will seek to attain social welfare goals, as well as economic efficiency (i.e., least cost). Sometimes there is a trade-off between social welfare and economic efficiency Other times, there is a positive gain in bath accounts.

4. Government Intervenes to Get Fair Value for the Use of Public Property.

A. Use of Public Property.

Local governments routinely lease, in the form of franchises, the use of public rights-of-way in exchange for compensation. Sometimes the rental fee is in cash, sometimes in-kind, such as shared use of the conduit or facility.

The FCC just completed the second round of Personal Communications Service ("PCS") frequency auctions. The auctions generated $9 billion for the federal treasury. The successful bidders have a right to the frequency for a limited number of years.

But consider the problem of favoritism:

The award of public rights for private use has often been laced with corruption and scandal as bidders. attempt to use political rather than economic competition to gain cheaper access to the public property.

LESSON LEARNED: Normal market sale and auction mechanisms work to allocate public property for private use. However, when economic values are large, bidders often apply strong political pressure, even to the point of risking criminal activities, to gain an advantage.

B. Public Property as a “Free Good” or “Public Good”.

Public ownership is often rooted in recognition that the particular property is not subject to normal economic pricing and market allocation mechanisms. Classically, a “free good” is an important resource of benefit to all. Once it is provided to one consumer. it is available equally to others at no additional cost of production. Either one consumer must pay the entire cost of creating the “good”, or the government must pay for the good and pass its cost along pro-rata to all through the tax structure. Some examples of “free goods” are a maritime lighthouse, clean air, reduced traffic congestion, and prescription drug safety certification. Each of these is valuable to everyone who uses them. But after the initial expenditure, all following consumers get full benefit at no additional cost of production.

Global Positioning Systems (GPS) consist of a system of satellites put in orbit by the military originally to enhance navigation and positioning for national defense purposes. However, once the government made the investment, civilians were able to take advantage of GPS positioning capabilities for a wide variety of non-military applications without having to pay for the costs of the satellite transmissions, only the cost of an increasingly inexpensive GPS receiver.

A Geographic Information System (GIS) may be assembled at great expense to the government. Once in place, every request for data that resides in the GIS costs essentially nothing to provide.

LESSON LEARNED: Free goods are classic government services. The benefit is available to all. The government tax mechanism allows the burden to be spread evenly throughout the society.

The table at Figure 2 summarizes other lessons learned from each of the industries examined in the Task B Report.

D. OVERALL OBSERVATIONS

1. Government intervention often leads to unintended results.

- Be cautious in seeking to create incentives or influence the behavior of private firms or markets.

- Intervene in increments.

Technology	Key Characteristics	Policy Adopted	Lessons Learned
Cable Television	. Wire technology needing public right of wav	. Franchising to promote universal service Policy evolved as market developed	Franchising encouraged rapid deployment but was co-opted by cable industry
Direct Broadcast Satellite (DBS)	Limited spectrum yields limited exclusivity	. Spectrum regulation . Mandated access to cable programming	Limited exclusivity needed to attract risk capital
Broadcast Television	. Strongly consumer driven mass market	Mandated signal format standards . Limited content regulation ("fairness doctrine")	Consumer demand essential . Technical standards a key element
High Definition Television (HDTV)	. Luxury upgrade of TV	. Signal format standards will be mandated	. Delays in standards process have allowed major technology improvement . Broadcasters "pocketed" the HDTV spectrum and seek to use it for other purposes
Telephone	· Wired technology needing public right of way · Desire for universal service	. Initially, rate regulated franchises . Separation of local and long distance services . Deregulation of toll service . Pending deregulation of local service	· Regulated franchises help to develop a market and to achieve universal service · In a mature market, competition leads to great innovation and lower prices · Standards and interoperability successfully developed under a single nationwide private enterprise
Cellular Telephone	. Wireless technology with limited available spectrum	. Duopoly regime to promote competition	· Overwhelmingly successful after a slow start
Geographic Information Systems	. GIS data cut across jurisdictional lines . GIS and digital maps for ATIS/ATMS are closely related	. Multijurisdictional agreement . Spatial data transfer standards	· GIS cooperative agreements instructive for ATIS/ATMS · Nationwide common data formats are essential
Global Positioning Systems	. Can locate any object precisely anywhere on the globe . Global system virtually demands global standards . Civil use of military systems . Highly capital intensive technology with huge external benefits	· Evolved into a dual use (military/civilian) technology · Fully publicly financed	· Civilian markets have undermined centralized military control of accuracy · Without military justification the public financing would not have occurred

FIGURE 2. TABLE OF INDUSTRIES STUDIED AND RESULTS (Cont.)

Electric Power Generation	· Triad of generation, transmission and distribution · Use of public rights of way · Need for system reliability · Universal service essential	· Forbearance toward monopoly varied over time · Federal, state and local regulation · Public and private providers · Public utility districts and power pooling for reliability	· Regulated franchises helped rapid deployment · Natural monopoly difficult to justify over the long term · Reliability important but can be elusive
Water Supply	· Distribution system requiring public rights of way	· More and larger public than private systems · Opportunities for achieving standards and economies of scale are often passed by	· Regional and local approaches often in conflict · Publicly owned and funded systems successful · The right balance of regulation and technical standards can foster innovation
Refuse Collection	· Low technology service · Mobile delivery of service · Purpose is to enhance environment and public · Potential harm to environment and health if mismanaged	· Service provision evolved from private to public, and more recently back toward private · Both regulated and market driven (e.g., recycling)	· Both public and private provision have been effective · Regulation should specify outcomes (e.g., safety or cleanliness), not the methods of achieving them
Electronic Funds Transfer	· Electronic replacement for cash transactions (point of sale) · Requires extremely high levels of security · Extensive internetworking	· Government stayed out of the way · States mandated sharing of ATMs · Interstate cash withdrawals ruled consistent with interstate banking laws · Competition increased by deregulation of financial services industry · DOD encouraged use of bar codes by requiring them for products if purchased	· ATIS can "piggy-back" on EFT · It takes time for customers to become familiar with new technologies · Customers clearly perceive their own interests -- ITS will need to prove its value · Electronic toll collection raises same privacy issues as EFT
On-Line Services	· Private sector benefitted from large-scale public investment in development of Internet	· Small flat fee for access to basic services · Lack of regulation has encouraged private sector use of public network	· Public investment can yield private investment and private competition · Public sector must learn how to capture portion of revenues to recover costs · Advertising may discourage some users
National Weather Service	· Partnership of public, private and volunteer sectors collects analyzes and disseminates information	· Adoption of national information management plan	· Large quantities of data can overwhelm system · Politics and economics may significantly offset institutional framework

FIGURE 2. TABLE OF INDUSTRIES STUDIED AND RESULTS (Cont.)

- Build in fall-back positions.

- Have an exit strategy from the beginning.

2. Franchising is effective for granting use of public property in exchange for public service obligations.

   - Limit public concessions to a minimum.

   - Build in sunset provisions, policy transitions, and exit strategies.

   - Balance conflicting interests in advance.

3. Innovation is stimulated by competition, not regulation.

   - Look for strategies to weaken economies of scale."

   - Where strong economies of scale exist, act strongly to control monopoly behavior.

4. This is complicated policy and implementation.

   - Have complete "models" for local communities so they do not have to start over with each project.

   - Avoid sacrificing long term interests for short term budgetary convenience. Limited short term benefits may not warrant long term costs (i.e., free service to schools is not a fair exchange for a long term monopoly grant).

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[21] See, discussion infra at Chapter 4 for description of economies of scale. Where the dominant costs of a vendor are characterized by declining average cost per unit of production, competitors will have little or no opportunity to enter the market and challenge the incumbent.

See also, discussion infra at Figure 3. The Decision Tree illustrates the practical effects of economies of scale.

CHAPTER 3

CABLE TELEVISION -- A LESSON IN FRANCHISING

A. INTRODUCTION

This chapter examines the history and results of cable television franchising. This "lesson learned" is central to consideration of the use of franchising as a deployment strategy for ITS. Later, Chapter V reviews the model ATIS and ATMS franchises prepared as part of this study.

As described in the conclusions to this chapter, cable television franchising embodies the nearest parallel to the likely comprehensive deployment of ITS. Cable franchising mistakes and achievements warrant careful consideration as the nation moves toward early, rapid ITS deployment.

B. A BRIEF HISTORY OF CABLE TELEVISION FRANCHISING

1. Early Development of Cable Television.

Cable started as remote rural service in the 1950's, where ITS deployment will likely begin in heavily congested traffic corridors, mostly urban. Nevertheless, there are parallels between each deployment in rural America and ITS in urban areas today because both types of communities felt strong pressure for rapid deployment of little understood technologies.

In the mid-1950's television broadcasting had developed in larger metropolitan areas, but there was little or no television service beyond a 50 mile radius of the largest cities. In places like Appalachia, rural New England, and the West, small entrepreneurs began to build tall television reception towers to pick up and amplify weak remote broadcast signals from big cities, and to distribute those signals on a coaxial cable wire to multiple homes in the rural community.[22]

The idea caught on rapidly. Soon most rural and remote communities throughout the Northeast, Southeast, Midwest, Rocky Mountain, and Far West regions were trying to induce local or outside investors to build cable systems.

Typically, investors obtained franchises that were simple rights to occupy the public rights-of-way for the purpose of operating a cable system. The grants usually were for very long terms, often 30 or more years. By allowing free use of the public rights-of-way and by

22 Thus the acronym CATV or "Community Antenna Television".

making the grants freely transferable over a long period of time, the franchises were a means by which the community reduced the cost of construction and operation and raise the likelihood of profits.

Fearing competition, broadcasters in smaller urban areas outside the major metropolitan zones successfully persuaded the FCC to restrain the growth of cable television. The FCC instituted a series of requirements on cable operators that made operating in a smaller community with a television station very difficult. Primarily, the FCC refused to license the importation of the television signals from the major cities into these smaller markets by the cable systems. This prevented the cable operators from offering any programming not available from the local broadcaster, effectively killing the cable business except to enhance signal reception. The FCC lifted its freeze under pressure from cable operators and consumers in these smaller communities in 1972.

Most smaller cities were unschooled in the esoterica of federal communications law. Residents of these communities wanted television service equivalent to that in the big cities. Eventually, consumer pressure forced the FCC to relax the freeze on small market cable operators and the FCC permitted small market cable systems to import television signals from the bigger cities. At the same time, in 1972, the FCC stated publicly that local cable franchises were valuable grants, and encouraged cities to adopt a more sophisticated set of community service requirements and a more rigorous process for selecting cable franchisees.

2. **A** Model Franchise Develops.

The Urban Institute responded to the FCC's call for more guidance to local officials in cable franchising. Under a major ten-year grant from the Ford Foundation, the Urban Institute created the Community Television Information Center (CTIC). The first major project of CTIC was to prepare a "model cable television franchise". The Center then hired and trained a staff of expert lawyers, planners, and engineers who provided advice on request to individual communities considering issuing a cable franchise. Practically all of the franchises issued in the nation from 1974 through 1978 were direct or indirect products of CTIC and the Urban Institute.

The "Model Franchise" of CTIC immediately produced major changes in the landscape of cable television. Cities began routinely awarding franchises through competitive bid Requests for Proposals (RFP). Successful bidders were selected on the basis of the highest quality service, technology, and lowest prices offered. The Franchises were for much shorter terms, usually no longer than 15 years, which was considered adequate to recover the capital investment. And the franchises contained operator performance obligations with significant enforcement mechanisms and transfer controls to protect the community.

LESSON LEARNED	A "model" is esssential to allow multiple jurisdictions to act simultaneously in a consistent, if dissimilar, manner. A "model" greatly shortens the analytical time and avoids duplication of effort.

3. Major Metropolitan Areas Begin to Franchise.

Unlike ITS, cable television started in rural areas and moved slowly to the major urban centers. The reason was the nature of the service. Until 1976, cable systems had only one type of programming -- retransmitted television signals. In rural areas with no television at all, cable was a great business. In smaller cities with only one or two local television stations, the importation of more signals from the nearest major city was a good business. But in the major urban centers, cable had no business because it had nothing unique to offer.

This all changed in 1976, the year Home Box Office (HBO) went on the satellite. Suddenly, cable had unique programming of its own that was not available from any broadcaster in a major city, and cable television took off as a viable business in the big urban areas.

Franchising changed as well. The larger cities had professional staffs well aware of the complexity and value of rights-of-way grants and communications networks. The business and subscriber community had observed cable technology in the rural environment and concluded it was capable of more than simple entertainment television. And the Urban Institute model franchise had caused enough anxiety in the cable television industry that the industry was appealing to the FCC for relief from “over-reaching” municipalities.

A few communities were slowed or diverted by charges of official or personal impropriety in franchise awards. Most jurisdictions, however, strictly adhered to their procurement regulations and followed the logic of the RFP process normally used in government procurement to get full value of the franchise for their communities. These “auctions” reached their peak in the 1978 to 1982 period.[23]

Thus began a period of sophisticated negotiations between the individual metropolitan jurisdictions and bidding operators over the “cable-related needs and interests” of the communities. CTIC and other consulting and law firms became active in advising individual client jurisdictions and in sharing “lessons learned” from earlier negotiations in other communities.

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23 Television & Cable Factbook. No. 63, VI (1995).

LESSON LEARNED:	Competitive RFP's for monopoly or competitive franchises can work well. Franchises offer the opportunity to design the system to meet the community's particular needs. However, franchising works best where there are useful models and local communities have the benefit of prior experience and analyses.

4. The Federal Communications Commission Preempts.

Cable operators were competing intensely for the major urban area franchises, offering more and more community benefits to outbid other operators. Operators turned to their national association to persuade the FCC to stop this bidding process. In response, the FCC first put a ceiling on the franchise fee a city could accept and then prohibited cash bids and non-cable related promises entirely, forcing cities to accept in-kind proposals based on video equipment, community programming channels, and operational support for those channels.

LESSON LEARNED:	The federal government has no monopoly on expertise. Local communities may be in the best position to adapt technology to local applications. Federal authorities may be more susceptible to focused lobbying by entrenched industries than widely dispersed, multiple jurisdictions acting in parallel.

5. The Cable Act of 1984 and the Current Situation.

The cable industry faced a series of franchise renewals from rural communities, just as franchising in major metropolitan areas was winding down in 1982. Also, major urban jurisdictions had generally insisted on the power to regulate cable rates if competition was not present in the market. The industry turned to Congress for relief.

In 1984, Congress passed the Federal Cable Act.[24] The Act represented a compromise between major cities and the cable industry. The industry was freed from rate regulation. The Cities were assured that promises made in recently issued franchises would

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24 Cable Communications Policy Act of 1984. 47 U.S.C. §§ 521 et ***seq.*** ("1984 Cable Act").

be fully enforceable. The cable industry was given a right to a renewal process that was so cumbersome it was unrealistic for any but the largest communities to consider non-renewal of the incumbent operator.

Given the opportunity for monopoly profits, the cable industry built the country fast. In 1975, only 9800,000 television homes of the nation had cable, consisting mostly of rural and a few urban areas. By 1986, 37,500,000 homes had cable!

However, cable pricing behavior was causing consumer unrest. Cable prices had increased at three times the rate of inflation from 1984 to 1992. The promise of competition among video providers had not developed. And, with very few exceptions, the cable industry had confined itself to video entertainment, avoiding new service offerings such as security alarm, two way data transmission, and telephony, for which cable technology and consumer demand were not present.

Congress passed a new law in 1992 mandating competition and ordering nation-wide price regulation until competition might emerge.

LESSON LEARNED:	Quick build-outs result from monopoly opportunities. However, the investor's interest in maximum return on investment may not result in the best, or most current technology or service. An unregulated monopoly is politically unstable and consumers will demand regulation of prices, quality and services if competition does not emerge.

C. CONCLUSIONS

1. Communities can have varied requirements and still generate a “seamless national network” of interoperable facilities.

2. Potential cash flow/return on investment will define the level of risk, private investment, and ability to define community requirements to place on the operator.

3. Long franchise terms for monopoly service providers will slow innovation.

4. Competitive bidding, properly structured, will generate maximum community benefits.

5. Communities need good models to shape the process properly.

CHAPTER4

MODELS OF ATMS/ATIS DEPLOYMENT

A. INTRODUCTION

A major task of the study was to examine alternative models of public and private sector involvement in the deployment of various types of user services related to Advance Traffic Management Systems and Advanced Traveler Information Systems. The Final Report for Task C enumerates these arrangements and discusses their implications in terms of lifecycle; economic benefits and costs; adaptability to ATMS and ATIS; and likely effects on speed of deployment and market penetration.

The most desirable balance of public and private involvement depends on the resolution of key economic questions related to barriers to entry and exit; conditions of natural monopolies that may exist; the potential for full or partial cost recovery; and the ability of projects to internalize external costs and benefits. Each form of private/public participation has different strengths and weaknesses in application to the various potential services provided by ATMS and ATIS.

B. KEYECONOMICISSUES

1. A Public Good versus Private Good.

A "public good" refers to a product or service that is automatically provided to all people in a market once it is provided to any. The marginal cost of additional consumption is zero. Good examples are street lighting and national defense. These cannot be selectively supplied to consumers. And the amount one person consumes does not affect the consumption of another.

By contrast; a "private good" allows exclusion of all consumers except those specifically authorized. What is produced and consumed by one individual is not available to any other. This creates a market price. The product will go only to the consumers willing to pay the highest prices. Value is reflected in the price and the price excludes those unwilling to pay. The scarce benefits of a limited amount of the product go to the highest valued use, and there is what economists call "economic efficiency in allocation of the good."[25]

[25] As the price goes up, fewer consumers are willing to pay the price and the quantity of the product demanded goes down. A chart of these various quantity vs. price points will produce a "demand curve" for the product. The curve describes the amount of product that will be demanded at various prices.

Most transportation goods contain some mix of both public and private characteristics. For example, a driver assumes a highway is a public good. However, as congestion builds, the driver begins to make choices to use or to not use the highway--a form of a non-cash price which allocates the good. Cash charges such as tolls can be used to ration the resource even more effectively.

A major question in ITS policy is the extent to which traffic information should be considered and treated as a public or a private good. One reason to treat the data as a public good is to provide it universally to all people of all incomes and geographic areas. This has the potential to minimize the problems of congestion and pollution. However, public good treatment means there is no direct cash recovery possible. It is likely that at least some businesses and individuals would pay to have access to the data. And they might pay substantial sums to have exclusive access to the data. In other words, the traffic data has value because it adds economic value to some activities directly, such as trucking companies' routing decisions. This means those activities should be willing to pay for the data, provided it is not freely available elsewhere.

2. Economies of Scale and Low Marginal Costs.

The mirror image of the public vs. private good question is the problem of economies of scale, coupled with market barriers to entry and exit. An economy of scale exists when a producer enjoys declining average costs of production for each additional unit of output. In this situation, competition is unlikely because a new entrant will always have a higher average unit cost of production. The problem is aggravated if the industry also experiences high barriers to entry and exit, characterized by large initial capital investments with little or no ability to withdraw the capital. Building a telephone or cable television system are classic examples of high entry costs and high penalties for leaving the market because the facilities cannot be withdrawn even if the business shuts down.

The clearest example in traditional transportation is a private toll road. A toll road provider faces market entry barriers--it is difficult to get the public and private rights-of-way to build. It requires large initial capital investment but has nearly zero marginal cost to the owner as traffic volumes increase. There is no practical way to withdraw the investment if the owner exits the market. Of course, each additional car may generate significant marginal costs for other drivers. Once the road is built, the investment is "sunk", quite literally. Nevertheless, through toll booth access control, the owner of the road can exclude all non-paying users. And the price charged can be totally unrelated to either the marginal cost of use or the average cost of use. The operator will be tempted to maximize profits by charging whatever the travel is worth to the user, even though there is no additional cost to the highway owner. This profit maximization would either exclude low value travellers, or would generate price discrimination, charging high value travellers a different price than low-value users.

In theory, the optimal level of output of a firm or industry producing private goods occurs when marginal revenues equals marginal costs. For a metropolitan area looking at ATMS/ATIS services, the efficient level of output occurs where marginal benefits equal marginal costs, including all internal and external costs and benefits. Real life is more complicated than theory. In metropolitan areas, individual jurisdictions may be unwilling or unable to carry their share of the costs of a common project. The jurisdiction will accept the benefits but not the costs to gain those benefits (the "free rider problem"). Additionally, government budgets are not usually tied to benefits but to acceptable levels of tax burden. Non-monetary benefits, such as community productivity gains through reduced congestion don't show up as increased tax receipts. If the government agency does not have a sufficient budget, the system will not be built, regardless of the non-monetary benefits to the wider community.

Understanding the efficient level of output is useful for judging whether a particular model of public/private participation is likely to supply ATMS or ATIS efficiently. This in turn leads to conclusions about market structure (should there be one or multiple providers?); the distribution of the costs and benefits of the ATMS/ATIS projects and services (how to deal with free rider jurisdictions?); and the allocation of risk for the projects between taxpayers and private investors (should a private provider be guaranteed against loss in the early years to stimulate the service startup?).

POLICY RECOMMENDATION: Necessary, but notsufficient, conditions for monopoly or exclusive rights to provide ATMS or ATIS services are:

1. There are large fixed costs or lumpy investment requirements for added capacity.

2. There are significant economics of scale.

3. Competition would significantly slow the speed of deployment.

The above conditions create the opportunity--and the risk--of a monopoly. A sufficient condition for monopoly provision would exist only if there was enough government oversight of the monopoly service provider to assure that the net benefits over the entire lifecycle to the public and private sector are greater than competitive provision.

C. THE IMPORTANCE OF CASH FLOW AND PROJECT FINANCING

The private sector anticipates several possible lines of business that could emerge from ATIS deployment. Various cash flows to support investment are possible under different ATMS and ATIS deployment strategies.

Figure 1 maps qualitatively the cash flows and other benefits that will flow from the deployment of ATMS and ATIS user services.

The diagram at Figure 1 schematically portrays public and private investment streams. These in turn create public benefits of reduced congestion, accidents, pollution, and energy consumption. At the same time, the information generated is repackaged and sold to consumers, creating cash flows (revenue streams) for value-added telecommunications service resellers, equipment manufacturers, personal communication service providers, and suppliers of computers, software, and telecommunications to homes and businesses.

Government must decide whether to confine its role to capitalizing ATMS (and basic ATIS), or whether to enter into broader, advanced ATIS services. For example, government could form a public/private joint venture that provides ATMS and basic ATIS data to private vendors of advanced ATIS services. It could then require the private vendors to pay the ATMS system for the raw information. Or the ATMS and basic ATIS services could be provided by a private vendor under government aegis, using government funds to capitalize the infrastructure and, in turn, require compensation from information resellers that reuse the information generated.

By making an investment that benefits certain private investors, the government may therefore serve the public interests by making ATMS data more broadly available to the public. If the alternative, based on the economics of a particular project, is that ATMS data will not reach a large portion of the public, this may be the best use of government funding in a particular case.

> If ATMS and basic ATIS user services are funded by government and provided as a free good then all of the revenue flows will accrue to equipment vendors[26] and to the information vendors.[27] This outcome may be appropriate and actually maximize the public and private benefits of deploying ATMS and ATIS.

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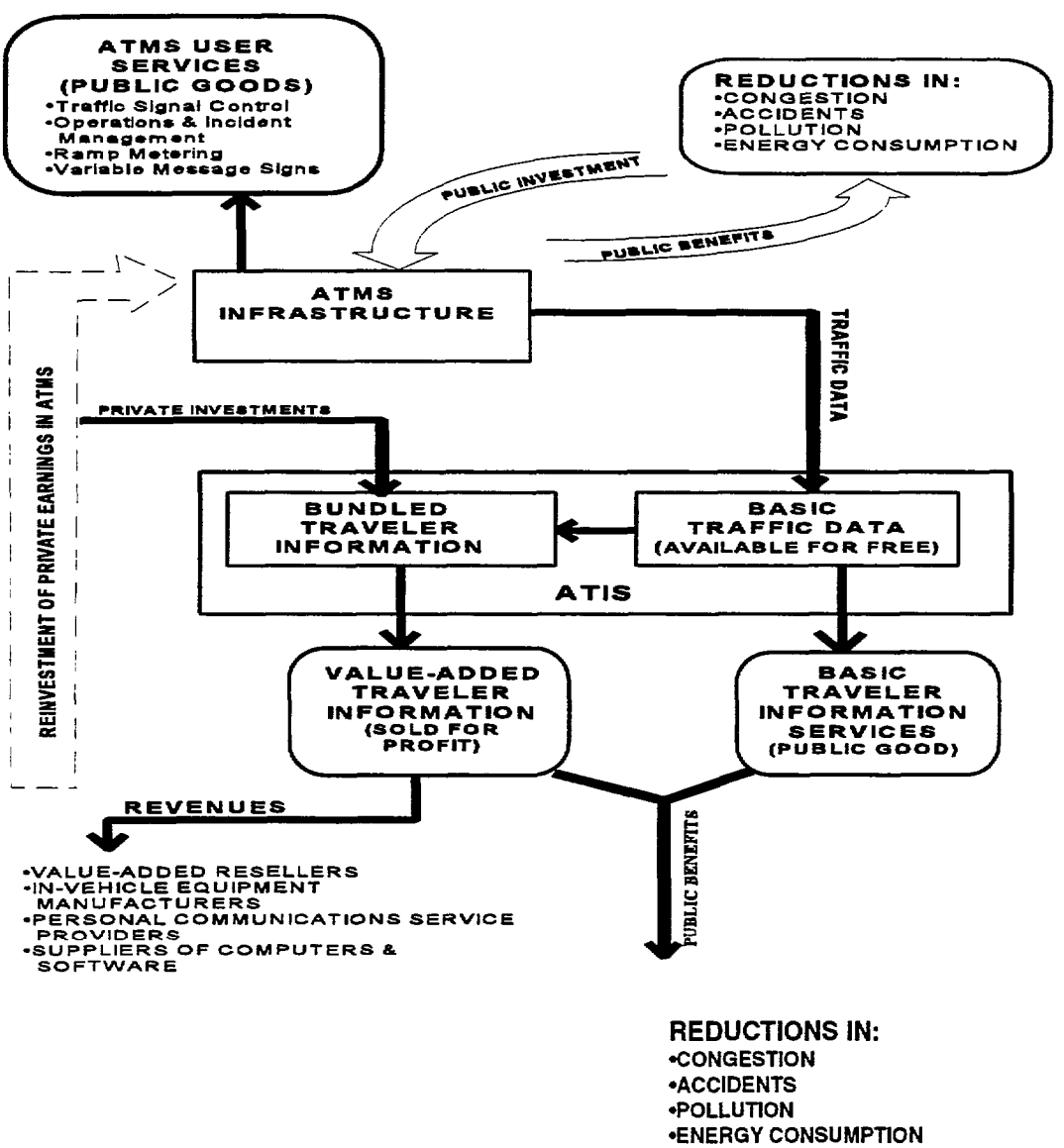
26 Computers, in-vehicle route guidance equipment. and personal digital assistants, are examples of equipment that could be used to access and handle the ATMS/ATIS information.

27 Information vendors are entities that sell value-added information to end-users. One possible method is to create user-specific information out of a combination of user profile information and basic ATIS data.

FIGURE 1

REVENUE FLOWS AND OPERATIONAL RELATIONSHIPS IN ATMS/ATIS



D. SEPARATE OR INTEGRATED ATMS AND ATIS SYSTEMS?

Figure 1 suggests interoperability and the exchange of information between ATMS and ATIS systems are important. But close integration of physical infrastructures of ATMS and ATIS is not critical and may actually slow deployment of both.

First, ATIS is not necessarily dependent upon traffic data emanating from the ATMS infrastructure. ATMS may be only one of several sources of information used by ATIS vendors. ATIS could be deployed independently of ATMS, using a variety of private surveillance techniques including the use of probes, aerial and satellite reconnaissance, closed circuit television, transponders, and the application of pattern recognition techniques to gather and link travel time information outside of the ATMS infrastructure.

> In the short run private and public surveillance systems may be far more cost effective in gathering information about congestion and travel time than developing a full-blown ATMS.

Evidence is mounting, based in part upon the field operational test in the Boston region, that the private sector can independently deploy ATIS and is not necessarily dependent upon data that emanates from an ATMS in order to provide pre-trip information or even en-route guidance. Companies like SmartRoute Systems, Metro Traffic Control, and Shadow Broadcast Services all use a variety of traffic surveillance techniques (e.g. aerial surveillance, cameras on building rooftops) not tied to data that comes from sensors installed in publicly owned rights-of-way.

This current experience raises a distinct, and troubling question. The market for basic ATIS information which an ATMS system can produce may be very limited. It is not proven that basic traffic information produced by ATMS will be distinctly different from data that can be gathered independently of any ATMS system. For example, commercial vendors of traffic data today rely on rush-hour airplane surveillance, volunteer cellular telephone reports, cable television system remote cameras, and monitoring of police and fire radios. Collating this information, and selling it to commercial radio and television stations to disseminate to the driving public is efficient and prompt. The question is whether ATMS- generated data will add much value to this other information already being gathered independently of any ATMS system.

If ATMS-generated data is not uniquely valuable, it will not sustain a second ATIS vendor which wishes to challenge the incumbent information vendor in the market. However, there is good reason to assume that basic ATIS data generated by ATMS should be treated as a public good available to all. In this event, even if the market will not sustain two ATIS vendors, the ATMS data will provide less costly data to the dominant vendor.

On the other hand, in the long run a fully-developed ATMS system may prove its worth by providing a comprehensive source of traffic data and a more efficient traffic management capability. Independent ATIS providers are unlikely to be able to develop complete traffic data covering a large area; they will probably have to concentrate on high-density or problem areas and will not have the resources to gather information on areas in between. In addition, ATMS is expected to permit real time, adaptive and integrated control of traffic over a regional network. This will produce massive, and instantaneous information flows that should provide significant advantages in drawing traffic data from ATMS rather than independent traffic surveillance systems. Therefore, even if independent ATIS providers succeed, there will be a place for full-scale ATMS.

> In the long run ATMS is likely to be preferable to independent traffic surveillance systems for providing dynamic information to ATIS services.

An alternative scenario presents itself. ATMS might be less expensive to deploy if it relies on private sector surveillance technologies. Those systems might rely on technology that does not require access to the rights-of-way. Or, if they did require such access, ATIS providers could be given limited licenses or franchises to install their equipment. In this event, ATMS would be a customer of the private sector ATIS vendor, rather than the more likely alternative discussed above.

> ATMS might prove most cost-effective by using private providers of traffic surveillance information to design, build, operate and maintain the information collection infrastructure, rather than the public sector building and operating its own information monitors.

A second reason for implementing separate ATMS and ATIS systems is to divide responsibility between the public and private sectors. Again, ATMS appears to have the characteristics of a public good -- once produced it is available to all at no cost.[28] The public sector is the traditional provider of public goods and likely has to deploy ATMS. On the other hand, economic efficiency argues it is better for the private sector to deploy a private good like ATIS.

Figure 1 suggest the ATIS retained earnings and ATMS user equipment economic rents could potentially be reinvested in expanding ATMS. However, this will only occur if

[28] See Chapter 4 for a detailed description of the economic theory of "public goods" versus "private goods" and the implication for government versus private sector provision.

the private sector can profit from joint participation in both ATMS and ATIS, and the whole operation is profitable.

RECOMMENDATION: ATMS and ATIS should be closely coordinated in deployment planning. Efficient and easy data transfer from ATMS to ATIS, and back, will expand the geographic coverage and market penetration of both ATMS and ATIS user services. Close coordination, including possible integration, will support and encourage the potential sharing of revenues earned from ATIS and ATMS.

E. PRIVATE SECTOR ROLE

1. The private sector will best identify and capitalize on the market opportunities related to traveler information services. It will develop effective ways of communicating traveler information services.

RECOMMENDATION: At a minimum the private sector should provide value added ATIS user service, possible including provide basic services.

2. Government can contract with the private sector for professional services and the supply of equipment and telecommunications.

3. The more government structures ATMS and ATIS as a private sector opportunity, the more the private sector role will expand and the level of public investment be reduced. However, there are risks of non-deployment if the private sector is asked to provide public goods that cannot be repaid by the market.

4. Private sector involvement requires:

- Sufficient revenue streams from service or equipment sales to pay for investment and operating expenses;
- A higher than normal return on the private goods to pay for the public good infrastructure providing public goods for free;"

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29 For example, private vendors of ATIS services may ask for rights to exclusivity and protection from competitive entry if they are expected to subsidize the ATMS infrastructure investment.

- Defined responsibilities between public and private sector activity to limit financial risks;

- Policy stability to recover the life cycle investment costs of the projects.

5. There are additional major obstacles to the private sector building and operating ATMS:

   - Access to publicly-owned and managed rights-of-way where traffic control equipment is placed;

   - Permission from government to manage traffic, which is government's responsibility under law;

   - The complex and costly challenges of achieving the multiple jurisdiction cooperation required to implement ATMS;

   - Resistance in many localities to implement ATMS quickly.[30]

In the ideal world, deployment of ATMS and ATIS will use the least possible investment, the lowest operating expenses, and generate the greatest social benefits in both public and private goods. This argues that a balance between public and private provision is likely to be best, assuming there are true public goods available from ITS. The line between public and private provision should be drawn at the point of departure between public goods and private goods.

Unfortunately, the world is not ideal. It is impossible to predict exactly what goods will be produced by ATMS and ATIS, which will be public and which private, and how valuable they will be to the society. As a result, the study concludes:

30 Communities list several reasons for going slow. These include fear that thoroughfare traffic will be routed through neighborhoods and local streets; higher priorities for pavement-related work than for operational improvements; lack of funds and staff to maintain and operate new systems once they are built; a general preference for home versus metropolitan rule; and the lack of legal authority to delegate traffic control responsibilities to a regional organization.

FUNDAMENTAL RECOMMENDATION: Use multiple test beds for deployment that will examine the full range of possible public/private provision combinations. To the extent the systems generate public goods, look for government provision, whether direct or through contract agents. To the extent the systems generate private goods, look for private provision with the broadest possible competitive entry. Where competition is not feasible due to economics of sc ale or limited revenue potential, look to regulation of the activities of the private vendor. Where there is a mix of public and. private goods, look to institutional arrangements that foster joint provision by the public and private sectors.

F. PRE-DEPLOYMENT PHASE OF PUBLIC/PRIVATE PARTICIPATION

The public and private sectors can work together toward deployment in two phases. The first is the phase consisting of technology development, planning and design, system architecture development, and operational testing, which might be referred to as pre-deployment. The second is the deployment phase. In most respects, technological innovation is not a pre-requisite to ATMS/ATIS deployment. Many have argued that ITS is not a new technology but a marrying of many existing technologies. Some technology is part of the installed base of existing traffic management systems. Other technology was developed for national defense, but the technology can be converted to civilian use. Still other technology is part of the emerging telecommunications revolution, but this technology is also waiting for ITS to harness it.

While the marrying of existing technology will require its own planning and design and the development of software and equipment tailored to ITS, in some respects there is no sharp distinction between the pre-deployment and deployment phase of ATMS/ATIS. ATMS will piggyback upon many legacy systems involving traffic control centers, automated traffic control systems, highway advisory radio, and changeable message signs already in place. The key challenges in implementation of ATMS and ATIS are systems integration and overcoming institutional barriers to regional deployment. Much of the pre-deployment phase of ATMS and ATIS is focused on these issues.

The pre-deployment phase of ATMS and ATIS is characterized by the development of a national ITS system architecture and the carrying out of a large number of operational tests. Operational tests are designed to test one and often more, new technological, institutional and financial elements in a real-world setting. Operational tests are different from research projects or other kinds of testing using simulation models, test tracks, or on public roads temporarily closed to the public. Also, a large number of early deployment projects are being carried out. Early deployment projects also represent a gray area between pre-deployment

and deployment. All operational tests and early deployment projects conducted to date have preceded the development of a national system architecture. As this architecture crystallizes, operational tests and early deployment projects will increasingly conform with it. When the national system architecture has been adopted throughout the country, the ITS program will truly have passed from the pre-deployment stage into the deployment stage.

There are a variety of institutional arrangements involving the public and private sector that pertain most strongly to the pre-deployment phase. These are discussed later in this chapter under the heading "Preferred Models for Pre-Deployment."

G. DEPLOYMENT MODELS OF PUBLIC/PRIVATE PARTICIPATION

A matrix appears in Table 1 summarizing the implications of different models of public/private participation that are potentially applicable to the deployment of ATMS and ATIS. These different models are:

(1) Pure public provision. A public agency owns, designs, builds, operates, and maintains the system.

(2) Public owner-builder. Similar to pure public provision, but the public agency may contract with the private sector to operate and maintain the system.

(3) Standard low-bid contracting. Competitive procurement involving bids based on the lowest first cost and normally involving method specifications as opposed to performance specifications.

(4) Lifecycle contracting. Competitive procurement involving selection of the bid that has the lowest lifecycle cost or that gives considerable weight to lifecycle costs in the award of a contract.

(5) Performance contracting!. Competitive procurement based upon selecting a contractor that can meet performance specifications based on the lowest overall costs (preferably lifecycle costs).

(6) Public turnkey (including Build-Transfer-Operate (BTO) and Build-Operate-Transfer (BOT)). A public owner that contracts for the design, building and perhaps, in addition, maintenance and operation of a system. May involve toll or private financing with limitations on the prices consumers can be charged and the rate of return on investment. May involve the sale of the constructed facility back to the owner of the right-of-way followed by leasing the facility in order to operate it. This model can also involve turning responsibility for maintenance and operation back to the public owner after the contractor earns a reasonable return on its investment.

TABLE 1: MODELS OF PUBLIC/PRIVATE PARTICIPATION

ORGANIZATIONAL MODEL	INVOLVEMENT AT STAGES OF LIFE-CYCLE						ECONOMIC ISSUES							ADAPTABILITY		SPEED OF DEPLOYMENT & MARKET PENETRATION	
	Initial Ownership	Design	Build	Operate	Maintain	Final Ownership	Entry	Exit	Economies of Scale	Competition vs. Monopoly	Costs & Risks	Consumer Price	Benefits	ATMS	ATIS	ATMS	ATIS
1. Pure Public Provider	Pu	Pu	Pu	Pu	Pu	Pu	R	B		GM	NR,IA	FL	PB	L	L	L	L
2. Public Owner-Builder	Pu	Pu	Pu	Pu,Pr,OPu	Pu,Pr,OPu	Pu,Pr,OPu				GM,CS	NR,LC,IA	FL	PB,PM	L	L	L	L
3. Standard Low Bid Contracting	Pu	Pu,Pr	Pr	Pu,Pr	Pu,Pr	Pu				CC,CS	NR,IA	FL	PB,PM	L-M	L-M	L-M	L-M
4. Lifecycle Contracting	Pu	Pu,Pr	Pr	Pu,Pr	Pu,Pr	Pu				CC,CS	NR,IA	FL	PB,PM	M-H	M-H	M-H	M-H
5. Performance Contracting	Pu	Pu,Pr	Pr	Pu,Pr	Pu,Pr	Pu				CC,CS	NR,IA	FL	PB,PM	M-H	M-H	M-H	M-H
6. Public Turnkey	Pu	Pr, OPu	Pr, OPu	Pu,Pr,OPu	Pu,Pr,OPu	Pu,Pr,OPu				CC,CS	CR,LC	CP	PB,PM	H	M-H	H	H
7. Private Owner-Builder	Pr	Pr	Pr	Pr,Pu,OPr	Pr,Pu,OPr	Pr,Pu,OPr				CC,CS	CR,LC	CP	PM	L	M-H	L	M-H
8. Private Turnkey	Pr	OPr,Pu	OPr,Pu	OPr,Pu	OPr,Pu	Pr,OPr,Pu				CC,CS	CR.LC.RP	CP	PM	L	M-H	L	M-H
9. Private Competition	Pr	Pr	Pr	Pr	Pr	Pr				CC,CS	CR,LC	CP	PM	L	H	L-M	L-H
10. Public/Private Competition	Pu	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr				CC,CS	NR,TC	CP	PB,PM	L	H	L-M	L-H
11. Auctions	Pu	Pr	Pr	Pr	Pr	Pu,Pr	R	B		MP,CC,CS			PM,RS,PB	L-H	L-H	M-H	M-H
12. Yardstick Competition (b)	Pr	Pr	Pr	Pr	Pr	Pr	R	B	J	MP	CR,TC	PR	RG,PB,PM	L	L	L	L
13. Open Solicitation	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr				CC,CS	CR,RR,TC,LC		PM,RS,PB	L-H	L-H	L-H	L-H
14. System Manager	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	R			MP,CC,CS,	CR,LC			H	H	M-H	M-H
15. Cost Sharing	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr				AT	CR,RR		PM,PB	H	H	L-H	L-H

Organizational Model
(a) = can be exclusive or non-exclusive
(b) = can be publicly-owned ROW and investor-owned company

Involvement at Stages of Lifecycle
Pu = Public
Pr = Private
OPu = Other Public
OPr = Other Private

Entry
R = Restricted

Exit
B = Barriers

Economies of Scale
J = Justification for Model

Competition vs. Monopoly
GM = Public Monopoly
MP = Monopoly Power
CC = Competition in Construction possible
CS = Competition in Service provision possible
AT = Antitrust can be an issue

Costs and Risks
NR = No cost Recovery if service Pure Public Good
CR = Cost Recovery built-in or can be added
IA = Information Assymetries (i.e. public sector lacks private sector market knowledge)
LC = Lifecycle Cost easily internalized
TC = Transaction Costs high
RR = Risk Reduction for the public and/or private sector
IE = Internalizes Externalities (positive and negative)

Consumer Prices
FL = Free or Low
CP = Competitive Price
PR = Price Regulation

Benefits
PM = Profitable Markets
PB = Public Benefits
RS = Revenue Source can be built in (e.g. toll collection)
RG = Rate-of-return Regulation

Adaptability and Speed of Deployment
L = Low
M = Medium
H = High

TABLE 1: MODELS OF PUBLIC/PRIVATE PARTICIPATION (Cont.)

ORGANIZATIONAL MODEL	INVOLVEMENT AT STAGES OF LIFE-CYCLE						ECONOMIC ISSUES							ADAPTABILITY		SPEED OF DEPLOYMENT & MARKET PENETRATION	
	Initial Ownership	Design	Build	Operate	Maintain	Final Ownership	Entry	Exit	Economies of Scale	Competition vs Monopoly	Costs & Risks	Consumer Price	Benefits	ATMS	ATIS	ATMS	ATIS
16. Joint Ownership	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr				AT,MP	CR,RR		PM,PB	L	H	L-M	M-H
17. Funct Division of Responsibility	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr				AT	CR,RR		PM,PB	L-H	L-H	L-H	L H
18. Competitive Joint Venture	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr			J	AT,MP	CR,RR,LC,TC	CP	RS,PM,PB	L-H	L-H	L H	L-H
19 Pub/Priv Consortium Under Public Agency	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	R	B		AT,MP	CR,RR,LC,TC	PR,CP	RS,RG,PM,PB	M H	M-H	M-H	M-H
20. Incentive Regulation	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr					TC,IE		PB	L	L	L	L
21. Public Franchise (a), (b)	Pu,Pr	Pu,Pr	Pr	Pr	Pr	Pu,OPu,Pr,Opr	R	B	J	MP,CC,CS	CR,RR,LC	PR	RS,RG,PM,PB	H	L-H	H	L-H
22. Business Franchise	Pr	Pr	Pr	Pr	Pr	Pr	R	B		CC,CS	CR,RR,LC	CP	PM	L	H	L-M	H
23. License (a)	Pu	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	R	B		MP,CC,CS	CR,RR	PR,CP	PM,PB	L-M	L	L-M	L-M
24. Concession (a), (b)	Pu	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,OPu,Pr,OPr	R	B	J	MP,CC,CS	CR,RR,LC	PR	RS,RG,PM,PB	H	L-H	H	L-H
25 Leasing	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	R	B		MP	CR	PR,CP	PB,PM	L-H	L-H	L-H	L-H
26. Government Aegis (a), (b)	Pu	Pu,Pr	Pu,Pr	Pr	Pu,Pr	Pu	R	B		MP,CC,CS	CR,RR	RR,CP	RS,RG,PM,PB	L-M	M-H	L	M-H
27. Monopoly Regulation (a), (b)	Pu,Pr	Pu,Pr	Pr	Pr	Pr	Pu,OPu,Pr,OPr	R	B	J	MP,CC,CS	CR	PR	RS,RG,PM,PB	L-M	L	L-M	L

Organizational Model
(a) = can be exclusive or non exclusive
(b) = can be publicly-owned ROW and investor-owned company

Involvement at Stages of Lifecycle
Pu = Public
Pr = Private
OPu = Other Public
OPr = Other Private

Entry
R = Restricted

Exit
B = Barriers

Economies of Scale
J = Justification for Model

Competition vs. Monopoly
GM = Public Monopoly
MP = Monopoly Power
CC = Competition in Construction possible
CS = Competition in Service provision possible
AT = Antitrust can be an issue

Costs and Risks
NR = No cost Recovery if service Pure Public Good
CR = Cost Recovery built-in or can be added
IA = Information Assymetries (i.e. public sector lacks private sector market knowledge)
LC = Lifecycle Cost easily internalized
TC = Transaction Costs high
RR = Risk Reduction for the public and/or private sector
IE = Internalizes Externalities (positive and negative)

Consumer Prices
FL = Free or Low
CP = Competitive Price
PR = Price Regulation

Benefits
PM = Profitable Markets
PB = Public Benefits
RS = Revenue Source can be built in (e g toll collection)
RG = Rate-of-return Regulation

Adaptability and Speed of Deployment
L = Low
M = Medium
H = High

(7) Private owner-builder. A private firm owns, designs, builds, and most likely, in addition, maintains and operates the system.

(8) Private turnkey. A private firm contracts with another private firm (or a public agency) to design, build, and possibly, in addition, maintain and operate the system.

(9) Private competition. Provision of a system purely through private competition in the market place, and having no public involvement.

(10) Public/private competition. A competitive bidding process undertaken by a government agency where the public and private sectors compete with one another to provide a product, service, or system.

(11) Auction. The public sector sells the rights to provide a service through an auction. Bidders are generally private companies but could include public agencies alone or in partnership with private firms.

(12) Yardstick competition. Using the prices charged consumers and the cost of provision by the public sector as a benchmark for determining (1) the price that a regulated firm should charge consumers and (2) the base to which the rate of return on investment is applied.

(13) Open solicitation of public/private partnerships. A competitive solicitation and selection process seeking ideas for joint public/private ventures where the public agency may offer to share a portion of the costs of projects selected.

(14) System manager. A public agency develops initial design and performance specifications for a system and contracts with a single organization, normally a private firm, to complete the design of the system and then build, operate, and maintain it. The system manager can be given considerable latitude in the approach to implementation including being responsible for preparing contract bid documents for various phases of deployment.

(15) Cost sharing. Any arrangement for sharing the costs between the public and private sector. Cost sharing can be in the form of direct or indirect payments, in money or in-kind, and apply to capital costs, variable costs or both. Funds can be raised through any method of public or private finance.

(16) Joint ownership. Any arrangement that involves the public and private sector sharing ownership. Joint ownership can include legal partnerships and for-profit or non-profit corporations.

(17) Functional division of responsibilities. A cooperative arrangement among the public and private sector in which responsibilities are assigned according to functions, roles,

or traditional responsibilities connected to ownership of property, equipment., software, telecommunications, etc.

(18) Competitive joint venture. An innovative model applicable to a facility which exhibits decreasing average costs, possibly including ATMS and ATIS, in which there is joint ownership of facilities, but competitive provision of output. A competitive joint venture is not unlike morning and evening newspapers which jointly own a printing press but compete with each other within the same service area.

(19) Public/private consortium under public agency (intermediary). A non-profit agency or corporation managed by a governing board composed of representatives of both the public and private sector and which can contract for services.

(20) Incentive regulation. Provision of a system under a regulatory framework which includes incentives for efficient provision of services, such as penalties for pollution and rewards for increasing public benefits. Incentive regulation may involve assignment of property rights to either the producer or consumer depending upon whether positive or negative externalities are involved.

(21) Public franchise. The granting by government of a special privilege to a private party, denied as a common right to all citizens, to make use of public property (usually public streets, easements, and/or rights-of-way) to achieve public benefits and private profit. Classic examples are traditional public utility franchises for electricity, telephone, water, gas, railroads, mass transit, and cable TV. Franchises typically have monopoly power and are regulated.

(22) Business franchise. A way for a franchise owner to earn money and replicate a business format in many different locations by requiring a franchisee to make an initial minimum investment, use a trademark or logo, furnish the product or service in conformance with a marketing plan, and the payment of a royalty or fee.

(23) License. The right or permission granted by government to carry on a business or engage in a certain activity that would be illegal without the license. A license is not a contract and usually does not convey to the licensee the right to occupy public property (e.g., liquor or drivers license). Note that the Communications Act of 1934 states that no Federal Communications licensee shall have a property interest in its license or the radio frequency spectrum it uses.

(24) Concession. A grant or lease by a private or public entity of a portion of premises for some use, or of the right to enter upon such premises, usually for purposes of commercial gain to the concessionaire and perhaps in addition to the grantor. A concession usually does not have a public interest component, but if it does, it becomes virtually indistinguishable from a public franchise.

(25) Leasing. The sale or franchising of the right to use a piece of property. Leasing strategies include Lease-Develop-Operate and Develop-Lease-Operate. Leasing can thus provide access to and use of public and private property necessary for one or more phases of deployment.

(26) Service provision under government aegis. The public sector grants the private sector the right to provide a service on an exclusive or non-exclusive basis as an extension of government and under the government banner in return for provision of the service and a share of the revenues.

(27) Monopoly regulation. Regulation of an investor-owned monopoly, usually a franchise, by a public utility commission or similar agency. Regulation typically focuses on the rates charged consumers and the rate-of-return on investment.

The Task C Report describes each of these alternatives in detail.

The matrix in Table 1 shows the involvement of the public and private sector in different stages of the lifecycle of ATMS and ATIS, highlights key economic issues, indicates the adaptability to ATMS or ATIS, and provides an assessment of whether the model would result in low, medium, or high speed of deployment for ATMS and ATIS.

Pre-deployment and deployment models of public and/or private involvement are not necessarily mutually exclusive. Some are compatible and some are not. Table 2 indicates which ones have at least some degree of compatibility and thus permit potential mixing.

H. DECISION TREE FOR SELECTION OF APPROPRIATE MODELS

Under different circumstances it is most appropriate for the private sector, the public sector or both, to provide ATMS/ATIS user services. The decision as to which of the 27 institutional models described in Table 1 is most relevant to a particular situation depends upon the following:

(1) Whether the public policy is to treat the service(s) to be provided as a public good(s), private good(s), or a combination of both.

(2) The willingness of consumers and/or taxpayers to pay for the services. When consumers are willing to pay, they will make a market that induces private providers to offer the service for profit. Sometimes consumers are unwilling to pay, but the taxpayer is, or a combination of consumers and taxpayers are willing to pay. It is important to define the service area and period of time over which the service will be offered in order to determine willingness-to-pay.

Table 2: Compatibility of Different Models of Public/Private Participation

	Pre-Deployment 1 Prog/System Manager	2 Cost Sharing	3 Partnering	4 CRDAs	5 Design/Build/Op	**Deployment** 1 Pure Pub Prov	2 Pub Owner-Builder	3 Std Low-Bid	4 Lifecycle Contracting	5 Perfor Contracting	6 Pub Turnkey	7 Priv Owner-Builder	8 Priv Turnkey	9 Priv Competition	10 Pub/Priv Competition	11 Auctions	12 Yardstick Comp	13 Open Solicitation	14 System Manager	15 Cost Sharing	16 Jt Ownership	17 Funct Div Resp	18 Comp Jt Vent	19 Pub/Priv Consortium Under Pub Agency	20 Incentive Reg	21 Pub Franchise	22 Business Franchise	23 License	24 Concession	25 Leasing	26 Gov Aegis	27 Mono Reg
Pre-Deployment																																
1 Prog/System Manager	—																															
2 Cost Sharing	•	—																														
3 Partnering	•	•	—																													
4 CRDAs	•	•	•	—																												
5 Design/Build/Op	•	•	•	•	—																											
Deployment																																
1 Pure Pub Prov	•	•	•	•		—																										
2 Pub Owner-Builder	•	•	•	•		•	—																									
3 Std Low-Bid	•	•	•	•			•	—																								
4 Lifecycle Contracting	•	•	•	•	•				—																							
5 Perfor Contracting	•	•	•	•	•		•		•	—																						
6 Pub Turnkey	•	•	•	•	•			•	•	•	—																					
7 Priv Owner-Builder	•	•	•	•	•							—																				
8 Priv Turnkey	•	•	•	•	•				•	•			—																			
9 Priv Competition	•	•	•	•	•								•	—																		
10 Pub/Priv Competition	•	•	•	•	•			•	•	•	•				—																	
11 Auctions	•	•	•	•	•						•		•	•		—																
12 Yardstick Comp	•	•	•	•	•												—															
13 Open Solicitation	•	•	•	•	•		•		•	•	•	•	•					—														
14 System Manager	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	—													
15 Cost Sharing	•	•	•	•	•					•	•	•	•			•		•	•	—												
16 Jt Ownership	•	•	•	•	•			•	•	•						•		•	•	•	—											
17 Funct Div Resp	•	•	•	•	•		•			•	•	•	•			•		•	•	•	•	—										
18 Comp Jt Vent	•	•	•	•	•				•	•					•			•	•	•	•	•	—									
19 Pub/Priv Consortium Under Pub Agency	•	•	•	•	•			•	•	•	•	•			•	•	•	•	•	•	•	•	•	—								
20 Incentive Reg	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	—							
21 Pub Franchise	•	•	•	•	•				•	•	•					•	•	•	•	•				•	•	—						
22 Business Franchise	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	—					
23 License	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	—				
24 Concession	•	•	•	•	•				•	•	•					•	•	•	•	•				•	•	•	•	•	—			
25 Leasing	•	•	•	•	•	•	•	•		•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	—		
26 Gov Aegis	•	•	•	•	•				•	•	•				•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	—	
27 Mono Reg	•	•	•	•	•				•	•	•					•	•	•	•	•				•	•	•	•	•	•	•	•	—

• = compatible to at least some small degree

(3) Whether economies of scale in production or service provision are present (other than the need to avoid duplicate use of rights-of-way). Economies of scale might arise in merging data bases or in manufacturing. There are a number of implications of significant economies of scale. The first is that an economy of scale creates conditions of natural monopoly, since the service provider can always undercut the price of competition and drive competitors out of the market by expanding output and lowering price. Under conditions of economies of scale, a new entrant cannot recover future total costs based upon marginal cost pricing, which is usually the economically efficient price. And competitive entry is precluded.

(4) Whether access to rights-of-way are needed. Government agencies have control over local streets and are required to enforce the laws regulating use and operation, including the need to avoid duplicate and disruptive use of rights-of-way. In addition, government recognizes that publicly owned rights-of-way have value in the market place and will try to seek appropriate compensation for use of public property by private firms.

(5) Whether home or metropolitan rule applies. Some jurisdictions are unwilling or prohibited by law to cede control or authority governing the use and operation of their streets and highways to a higher regional body. In other cases a joint powers authority exists that allows multiple jurisdictions within a region to act in consort. Some deployment models are germane to a single jurisdiction while others can help form cooperative relationships among multiple jurisdictions. These cooperative relationships involve not just participating jurisdictions but also may apply to private sector providers.

(6) Whether legal authorization exists to support deployment under the specific model. Many models cannot be implemented without appropriate state and local authorizing legislation.

Figure 3 provides a decision tree that can be used to select the most appropriate model based upon the first four criteria listed above: public and/or private good, consumer and/or taxpayer willingness-to-pay, presence or absence of economies of scale in production, and whether right-of-way access is needed. These four criteria address issues of market characteristics and barriers to market entry. The remaining two criteria depend upon existing legal authority and the extent of multijurisdictional cooperation required within the area where ATMS/ATIS will be deployed.

Figure 3
Decision Tree

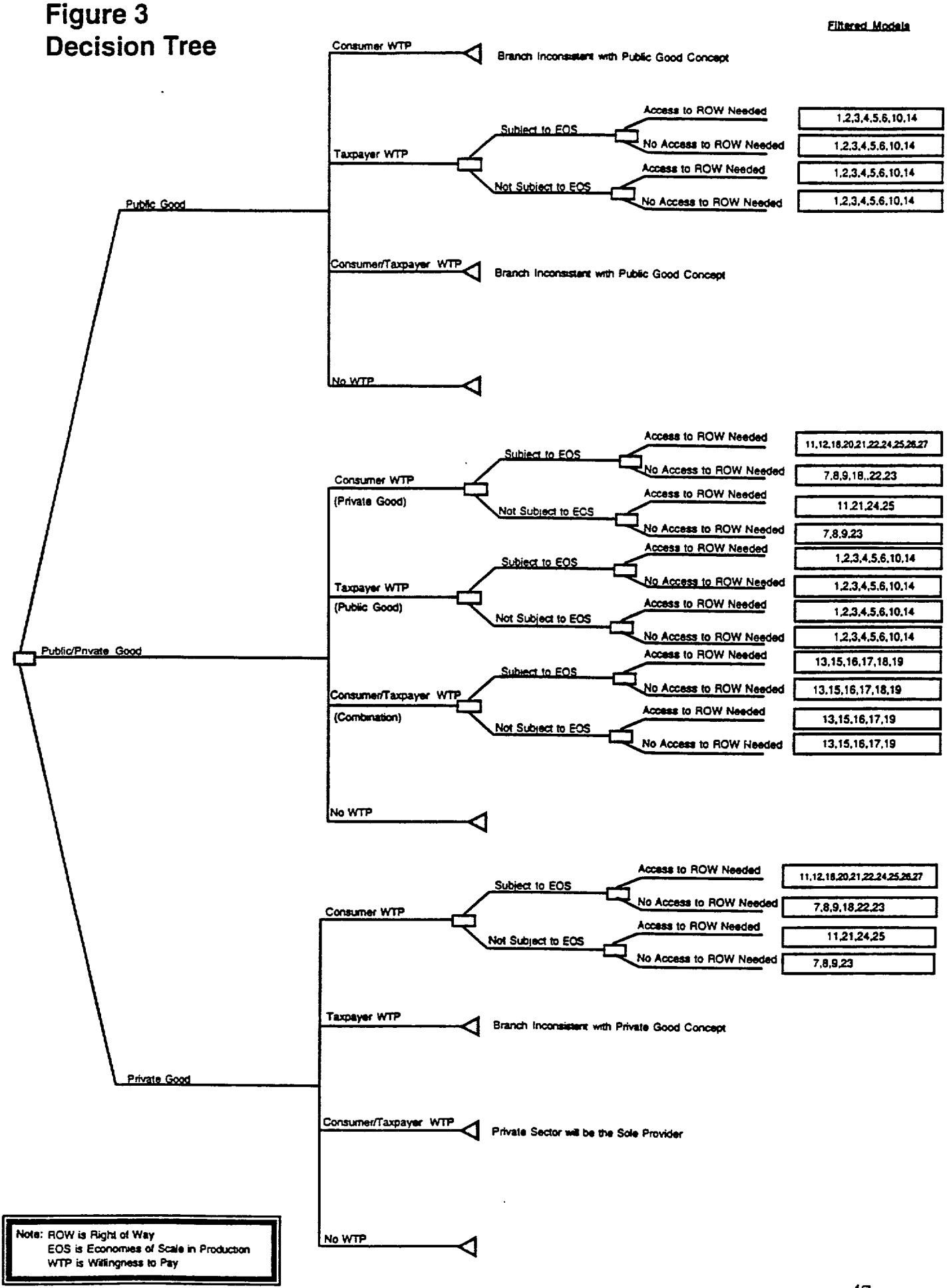

Figure 3 (Cont.)

Key to Models

1. Pure public provision.
2. Public owner- builder.
3. Standard low-bid contracting.
4. Lifecycle contracting.
5. Performance contracting.
6. Public turnkey (Including Build-Transfer-Operate and Build-Operate-Transfer).
7. Private owner-builder.
8. Private turnkey.
9. Private competition.
10. Public/private competition
11. Auction.
12. Yardstick competition.
13. Open solicitation of public/private partnerships.
14. System manager.
15. Cost sharing.
16. Joint ownership.
17. Functional division of responsibilities.
18. Competitive joint venture.
19. Public/private consortium under a public agency (Intermediary).
20. Incentive regulation.
21. Public franchise.
22. Business franchise.
23. License.
24. Concession.
25. Leasing.
26. Private provision and revenue sharing under government aegis.
27. Monopoly Regulation.

Figure 4 illustrates how to apply the decision tree. In the example, the product is considered to be a pure public good, and the consumer is not willing to pay for the product in the market place. The manufacture and distribution of the product has economies of scale and the sale of the product requires the use of public rights-of-way. Assume further that the product under consideration is to be offered in multiple jurisdictions. Whether legal authority exists to implement the model cannot be determined until the model is selected.

The Figure 4 results illustrate that the decision tree selects pure public provision as an appropriate approach. The decision tree also shows that the following additional models are relevant: Public Owner-Builder (2), Standard Low Bid Contracting (3), Lifecycle Contracting (4), Performance Contracting (5), Public Turnkey (6), Public/Private competition (10), which is a form of contracting, and System Manager (14). Each of these models would have to be tailored to a multi-jurisdictional environment. If any of these models were to be implemented, there would have to be corresponding legal authority.

I. PREFERRED MODELS FOR PRE-DEPLOYMENT

Five distinct approaches represent the most attractive alternatives for pre-deployment institutional arrangments:

(1) Program/system manager. This approach has a proven track record for complicated development and design programs requiring large public and private inputs. Either a public agency or a private contractor can assume the responsibility for the overall program development during the R&D, planning, and design stages. The role can extend into the deployment phase as well.

The concept is vulnerable to cost overruns. But it has worked well in the deployment of many major systems, including the defense sector. This approach requires broad inter-agency and inter-jurisdictional cooperation.

(2) Cost and Risk Sharing. The public and the private sectors both have much to gain from the deployment of ATMS and ATIS. This suggests that both should be willing to shoulder a portion of the direct costs and risks of the pre-deployment activities. The European experience in ITS suggests that cost sharing is a workable framework for public/private partnerships at the program level during the pre-deployment phase.

There is no single formula for cost sharing for R&D and operational tests, but the private sector has demonstrated willingness to enter into cooperative agreements to establish the relative public and private sector responsibilities.

Figure 4
Example Showing Selection
of Model Based on
Decision Tree Criteria

Filter	Single Jurisdiction	Multiple Jurisdiction
A. Market Characteristics 1. Type of Good **Pure Public** Public-Private Pure Private 2. Willingness to Pay Consumer **Taxpayer** Consumer-Taxpayer None		
B. Barrier to Entry 1. Economies of Scale **Existence of EOS** No Existence of EOS 2. Right of Way **Access Needed** No Access Needed		Multi-jurisdictional Pure Public Provision
C. Multi-jurisdictional		Joint Powers Authority Exists
D. Authorizing Legislation		No Limiting Legislation and Regulations are Present

(3) Partnering. Partnering is different than formal cost sharing. This approach normally requires public sector partners to use competitive procurement to select private participation partners. Operational tests can then be conducted under formally negotiated partnership agreements that assign the risks and benefits of the multiple activities required.

(4) Cooperative Research and Development Agreements (CRDA's). CRDAs are a result of federal legislation that provides a framework for government laboratory-industry coordination. Through CRDAs, government and industry can share intellectual property -- patents, software, copyrights, etc. -- that result from joint research. Government laboratory employees can collect royalties on their research products. Typically, the arrangements include formal public and private sector cost sharing.

(5) Design-Build-Operate. Pre-deployment can extend through the implementation phase if the entity that designs the system is also responsible for construction, operation, and maintenance.

J. PREFERRED MODELS FOR DEPLOYMENT

Thirteen deployment models are particularly interesting but each has disadvantages.

1. Performance and Lifecycle Contracting (including Turnkey Projects).

Approaches to government contracting that emphasize performance specifications as opposed to method specification and that also address lifecycle costs are good ways to implement ATMS and ATIS. Proven approaches for addressing life cycle costs of large projects, such as toll roads, and implementation of advanced technological systems include government contracts for turnkey projects involving design, build, operate and maintain as well as Build-Transfer-Operate (BTO) and Build-Operate-Transfer (BOT).

- Purpose is to emphasize desired outcomes as opposed to means of obtaining outcomes.
- Can provide for rewards and penalties.
- Can speed deployment because it simplifies preparation of bid documents and gives contractors more flexibility.

  Agencies less familiar with this approach than standard low-bid contracting

2. Pure Public Provision.

In a multijurisdictional environment certain elements of ATMS and ATIS would be offered through a consortium of public agencies working together under some type of agreement that shares cost and responsibilities. Public agencies that own the property where the system would be deployed would design, build, operate and maintain the system.

- May be effective for specific parts of an ATMS or ATIS system, for example, a data base for basic ATIS service that is offered for free to the public and value added resellers.

- Consistent with public ownership of rights-of-way and data developed by publicly funded systems as well as government responsibility for safe operation of public roads.

- Unlikely to be practical for an entire large-scale system.

- Public sector's knowledge of technology and ability to respond to customer's needs and market conditions often inferior to the private sector.

3. Public/private joint ownership.

One or more private organizations and one or more public agencies could jointly own a facility or a system such as ATMS or ATIS. There are many legal arrangements that would support joint ownership including legal partnerships and non-profit and for-profit corporations. Ownership confers on the property owners certain rights that do not accrue if only cost sharing is involved. These rights include the ability to sell or lease the property, to grant access or use of the property, and to earn a share of the profits from operation, sale of services, or proprietary spin-off technologies and applications. Different types of ownership structures also have very different tax advantages and disadvantages to both the private and public sectors. Tax savings that would accrue to the private sector usually imply corresponding revenue losses for the public sector.

- Permits a wide range of ownership structures.

- Implies both revenue sharing and cost sharing.

- Raises potential antitrust concerns.

4. Public Franchise.

Franchising has strong appeal for the rapid deployment of ITS because it helps create market conditions attractive to private providers of ATMS and ATIS user services while at the same time creating public benefits. A franchise tends to limit risk by providing considerable market exclusivity to the franchisee in return for meeting public interest objectives set out in the franchise agreement. The franchise agreement typically specifies a governing body or agent such as a commission or board that is responsible for ensuring the franchisee acts in the public interest.

- Usually exclusive, either de jure or de facto.
- Gives a right to use public property by a private entity for profit and public benefit.
- Usually has natural monopoly characteristics, warranting price and quality of service regulation.
- Can create a market and revenue stream.

5. Licenses.

The general definition of a license is the right or permission granted by the government to carry on a business or engage in a certain activity which, without the license, would be illegal. This definition is very similar to the broad definition of a franchise, and indeed the terms are sometimes used interchangeably.

- Not usually tied to use of public property.
- Not a contract or property interest.
- Usually few, if any, service obligations.
- Can grant some market exclusivity with respect to the number of providers, geographic coverage or both

6. Auctions.

Auctions are a method of selling, through a process of competitive bidding, an exclusive or partially exclusive right to occupy, use, or have access to public property. Auctions can also be used to sell public or private property.

Auctions could be used to sell the rights to develop ATMS or ATIS in combination with ATMS provided there is sufficient market value in selling services to attract bidders.

- Can attract significant investment capital if rights sold are valuable.
- Can sell a franchise, license, or concession.
- Can sometimes determine the degree of competition.
- Creates a price for property not previously valued.

7. Service Provision Under Government Aegis.

Under this model, government grants to the private sector the right to provide a service under the banner of government, thus creating a market opportunity or added revenue not otherwise possible. A private firm acts as an extension of government perhaps even using a government logo. There is a quid-pro-quo usually consisting of private provision in exchange for the right to act in behalf of government. However, the quid-pro-quo can involve additional private contributions or revenue sharing, especially if the right to act in behalf of government is essential to a profitable service.

- May create market assurance.
- Private vendor acts as arm of government.
- Cost sharing or service promises exchanged for right to act on behalf of government.
- Revenue sharing.

8. Competitive Joint Venture.

This is a technique for dealing with natural monopolies. The idea is to create a market for a facility that has declining average costs. Several owners own shares of capacity in a single facility so that they can each produce the same services. Each owner independently disposes of the output from its capacity in competition with other owners. It also has an open entry that allows anyone to expand output through investment in the facility, although entry can be partly restricted at first to encourage rapid deployment. The real-world example that comes closest to a competitive joint venture is the structure of some crude oil pipelines, including Trans-Alaska Pipeline System (TAPS). Each of these pipelines is jointly owned by several companies which independently post prices and transport oil for other parties. The fixed costs of the pipeline are paid by the owners in proportion to their ownership shares which define the amount of pipeline capacity that each owner may use to

provide transportation services. Variable costs of transportation are paid by the owners according to the amount they actually use their capacity.

- A way to allow for competitive provision of services that emanate from a facility that might otherwise require monopoly regulation.
- Compatible with franchising.
- Innovative, but not widely tested.

9. Open Solicitation.

A number of states -- California, Washington, Minnesota and Virginia -- have recently enacted innovative legislation that sets up a process where private firms can submit innovative proposals to the state to completely or partly finance transportation facilities, and then construct and operate them. The states in certain instances can cover part of the costs, or use their own funds to help leverage private capital. Only projects expected to generate significant revenues, such as toll road projects, are assumed to be viable.

- Fosters creative proposals.
- Priorities must be established by government entity.

10. System Manager.

Typically when an organization has program management responsibilities tied to a particular system, such as a regional ATMS/ATIS, the program manager is often referred to as a system manager. Under this arrangement the system manager becomes the responsible entity. The system manager could be a public agency, but often the government selects a private contractor. Typical responsibilities of a system manager include refining requirements and specifications, preliminary design, preparation of standard bid documents, supervision, and inspection of construction, testing and acceptance, systems integration, and operations support.

- Establishes clear responsibility for implementation.
- Provides for feedback and consideration of outside views.
- Requires oversight to ensure the system manager's wide ranging responsibilities are carried out as intended.

11. Public/Private Consortium Under a Public Agency (Intermediary).

An intermediary is a consortium established under a public agency designed to foster the needed cooperation among public and private participants. There are three potential forms of an intermediary. The natural candidate within a region for this inter-agency role is an MPO which already includes as members the local jurisdictions and providers of public transportation in the region. The TravInfo project of the Metropolitan Transportation Commission, the MPO for the San Francisco Bay region, presents a good case study of an MPO functioning as an intermediary to attract and hold private and public entity participation in an ATMS/ATIS project. A second intermediary alternative is the local ITS America chapter. The various chapters around the nation have a range of structures and powers. However each represents a meeting ground for public and private interests involved in ATMS/ATIS. In some cases, these chapters are the logical intermediary for their region. A third alternative is the model of HELP Inc. A derivative of the Heavy Vehicle Electronic License Plate Demonstration Program, it is a consortium of public and private agencies that have banned together into a single non-profit corporation that contracts for services in behalf of the public and private members.

- Some intermediaries like HELP Inc. are expressly designed to facilitate contracting for services, while others like ITS Chapters are not and rely upon their members to do so.

- Joint powers agreements between local agencies may be necessary to establish legal authority for many kinds of coordinated actions by local governments.

- Intermediaries are among the most successful vehicles for achieving public/private cooperation.

12. Private Competition.

Another possibility for ATMS/ATIS is the model of pure private competition. Government's role would be solely to enforce antitrust laws and ensure there are sufficient competitors. This is an attractive alternative if there are minimal economies of scale (including the need to use public rights-of-way) and if the technology and industry were mature so the risks and capital investments were readily quantifiable.

- Risks and profits or losses are the private sector's.

- No government funds required.

- May not maximize public benefits.

K. PROCUREMENT PROCESS

Whatever deployment model is selected, an effective procurement process is critical. State and regional transportation agencies, as well as other government bodies, all have extensive experience with contracting of various sorts and therefore will have a procurement process in place. These mechanisms may be adequate if an existing entity is to be in complete control of the process. If the particular deployment model selected calls for the creation of a new entity, however, or for cooperation among different private sector organizations and multiple public sector jurisdictions, establishment of an effective procurement process becomes much more important. In addition, existing procurement laws may not allow the use of some of the innovative deployment methods that will be necessary for ITS to succeed.

Therefore, successful deployment may first require legislation to establish the legal authority for any procurement to go forward. For example, several states, including the State of Washington, have enacted legislation to allow more effective private sector participation in financing, construction, and operation. The Washington legislation authorizes the Secretary of Transportation to explore the feasibility of using innovative agreements with the private sector to privately finance transportation systems, allows the Secretary to solicit, evaluate, negotiate, and administer public/private agreements and to take advantage of federal programs intended to foster public/private partnerships. Finally, the legislation establishes a revolving fund to help finance projects.

In addition, government entities will have to establish flexible processes for the issuance of Requests for Proposals, and will have to allow for the submission of innovative private sector proposals outside the traditional RFP process. Otherwise, the goal of fostering public/private partnerships will be restricted to the traditional approach, in which the private sector merely implements public sector initiatives.

The same holds true of contractual mechanisms. Traditional government contracting principles will continue to be important, but implementation of many of the deployment methods discussed above will require the use of different methods, or at least the adaptation of existing methods to new circumstances. In general, public sector participants will have to be open to a wider range of contract terms -- which may mean less control and greater risk -- than they are used to.

L. CONCLUSIONS

ATMS services will typically have zero or close to zero marginal costs to serve additional vehicles once the system is built. As a public good, (i.e., free to the public), some form of public provision is most likely if taxpayers are willing to pay the cost of construction and operation. On the other hand, most ATIS user services will likely be different and are not likely to be free to the public. The direct consumers of ATIS information will choose whether to pay enough to cover ATIS delivery costs and profit. Also it appears ATIS will have few, if any, economies of scale in production and little or no access to rights-of-way

will be required. This suggests that ATMS will be offered under some form of public ownership or exclusive private franchise. ATIS will be offered by private vendors under conditions of competition with some form of licensing of access to the ATMS data.

But assume two variations. First, if ATIS requires access and use of public rights-of-way, then some form of franchising or concession award will occur. Second, if ATIS does entail significant economies of scale then a competitive joint venture model is practical. This will combine a cooperative monopoly provision of ATMS by multiple operators and/or basic ATIS data, with competitive offerings of value-added or enhanced ATIS services.

BASIC CONCLUSION: The specific market circumstances will define the best approach to deployment of ATMS and ATIS. There is no single approach.

BASIC ANALYSIS: The choice of models depends on

- The level of public and private involvement desired at each stage of the life cycle;
- Issues of regulatory economics and
- Desired speed of deployment

BASIC COROLLARY: **Many models could generate revenues to contribute to cost recovery or profitability. This argues strongly for accommodating a wide variety of institutional arrangements, especially public/private partnerships as well as open solicitations to foster innovative approaches to procurements.**

CHAPTER 5

FRANCHISING, RIGHTS-OF- WAY, AND MODEL FRANCHISES

A. INTRODUCTION

Tasks E and F of the Study involved a detailed analysis of the strengths and applicability of franchising to ATMS and ATIS deployment. In addition, model franchises were prepared for both ATMS and ATIS.

A franchise is broadly defined as a special privilege conferred by government on a private party:

- To make use of public property;
- For public benefit; and
- For private profit.[31]

These characteristics make franchises particularly relevant to ITS services that may require access to rights-of-way and have strong economies of scale.

There are, of course, methods of granting access to rights-of-way, other than franchising. Such alternatives include licenses (discussed in the footnote below), permits, easements, leasing, and grants of title. Franchising offers an essential combination of control and flexibility, however. Permits, for instance, while they may be revocable and may be granted subject to conditions, do not imply a continuing relationship between the parties. Once the permit is granted, the permittee is free to operate so long as it meets the conditions. Easements and leases imply even less control, since they are grants of interests in land and are generally more difficult to revoke.

Finally, under a grant of title a government entity cedes all ownership, leaving it only with its inherent regulatory powers, which may or may not be sufficient. In any case, the critical distinction between a franchise and the alternatives is the expectation of a continued relationship between the parties that arises out of the public interest obligations inherent in a franchise.

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[31] Licenses are often confused with franchises. A license is a government grant of a right to engage in a line of business to which the government controls access. Most franchises contain elements of licenses since the franchise will normally specify the business purposes for which the franchisee may use the public property granted by the franchise. On the other hand, many licenses exist which have nothing to do with the grant of use of public property.

B. EXAMPLES OF FRANCHISING IN ACTION

1. Cable Television Franchises.

Chapter 3 describes the history and lessons from cable television.

The most important characteristics of franchising are:

- Fast deployment;
- Compensation to the local jurisdiction through franchise fees;
- Negotiations to create specific performance requirements;
- Variable length, balancing risk versus project payout periods
- Transferable as market conditions change;
- Competitive bidding to permit innovation and price control even though the service, once franchised, is a monopoly; and
- Public intervention and ownership possible if failure to perform.

Effective cable franchising requires the proper policy and legal environment.

Necessary factors included:

- State authorizing statutes and local regulatory ordinances;
- An orderly Request for Proposals process;
- Evaluation of difficult-to-quantify factors such as proposed service packages and alternative technology offerings; and
- Detailed negotiations with the successful bidder.

2. Cellular Telephone Franchises.

Formally, the FCC calls its cellular telephone grants licenses. But the licenses are more properly characterized as franchises. They are for specific geographic regions, based on exclusive rights to use federal radio spectrum. And the FCC agrees to not license more than two cellular operators in any region.

The FCC short-circuited several steps in normal franchising. It established uniform, nation-wide construction and operational standards and used a lottery system rather than a comparative evaluation for selecting the winners.

3. California Toll Road Franchises.

California had to solve several complicated institutional issues to get the toll roads into existence. The most important were:

- State authorizing legislation;
- Selection criteria; and
- Financing structures.

C. THE MODEL FRANCHISES

1. Key Assumptions Underlying the Model Franchises.

The Study designed model franchises for both ATMS and ATIS. The drafts depend on certain key assumptions (as reflected in Figure 1).

a. An ATMS system will produce both ATMS service and basic ATIS information. This basic information can then be enhanced into various ATIS services.

b. The ATMS system is expected to have strong economies of scale, suggesting only one provider of ATMS can exist in a particular transportation market.

c. ATIS services, aside from basic ATIS, will have no significant economies of scale or entry barriers. Open competition is a real possibility.

d. It is unclear what revenue streams the ATMS system may be able to attract. Therefore the ATMS draft franchise has "modules" to reflect different revenue potentials.

2. The Appropriate Compensation Mechanism.

The model ATMS franchise assumes that there are five general approaches to defining the relationship between an ATMS provider and a municipality or multiple jurisdictions if franchisor is agency with joint powers authority to act in behalf of others, depending on the extent of government financing required and the degree to which the project is expected to be profitable. Each of the resulting structures is referred to as a module. For example, if development of ATMS in a particular franchise area is expected to be a public good, or if policy considerations dictate that it be treated as a purely public good, then those provisions corresponding to Module A (defined below) should be selected. Conversely, if projections indicate that an ATMS system could be profitably built and operated by the private sector, then the provisions corresponding to Module E should be incorporated into the agreement between the franchisor and franchisee.

The five modules are defined as follows:

- Module A: ATMS is a pure public good and the only practical revenue stream is public subsidy. The franchisee is required to deliver the system's services at no charge, and is compensated by the government for its services. Because there is no private sector funding involved, this module is as much like a government contract as it is like a franchise. Finally, no revenue-sharing or other compensation mechanism is needed because there will be no project revenues to be shared. There are two service options possible under this module; these are discussed below.

- Module B: ATMS can produce some revenues from the sale of basic ATIS information. But a public subsidy is still required. Like Module A, this module contains many elements of a government contract: the government finances design and construction and pays the franchisee a management fee for operating the system. To reduce the public sector's cash expenditures, the franchisee is allowed to retain any project revenues as part of its compensation.

- Module C: ATMS can produce sufficient revenues to cover project operating costs. Therefore, the franchisee will bear all costs and retain the revenues but the city guarantees the franchisee a reasonable rate of return, to be made up with public funds as required. An alternative would be for the public sector to assist in financing construction. Depending on the economics of the project, this might reduce the franchisee's costs and produce the desired rate of return without supplemental government payments. This

alternative is not directly addressed in the model because the document is concerned with the operational issues between the parties.

- Module D: ATMS can produce sufficient revenues to make ATMS operations profitable, but not enough to pay back the initial capital costs. The government receives a token franchise fee (as in all the modules) in recognition of its right to compensation for use of the rights-of-way, and additional compensation out of operation revenues to defray its contribution towards the costs of construction and more accurately assess the value of the rights-of-way to the franchisee.

- Module E: ATMS can pay for all operations, capital investment, and a reasonable profit. This module provides for compensation to the city for use of the rights-of-way in the form of a franchise fee and the provision of facilities and equipment. The public sector could assist in financing the project, as in Module C, but this module assumes such assistance is unnecessary. It might be desirable, however, to compensate the franchisor through some means other than a franchise fee on gross revenues, and several options are presented, as in Module D.

Figure 5 presents the modules graphically.

3. Other Factors Considered in the Model ATMS Franchise.

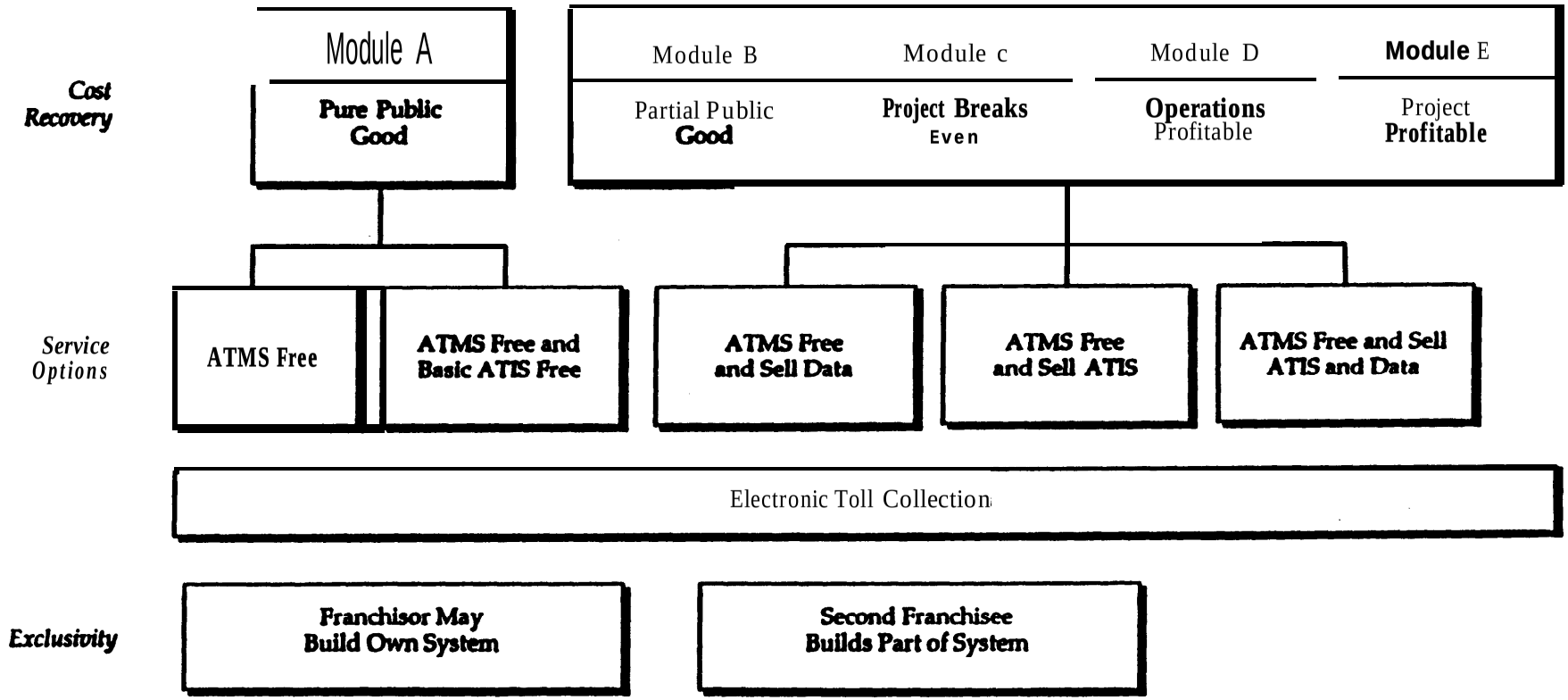
The other principal factors that give rise to the variants made possible by the model are:

The Identity of the Franchisor. For an ATMS system to be effective, it must have access to and provide information over an entire metropolitan area. This means that a multi-jurisdictional authority is required to oversee the system and coordinate among the member jurisdictions and with other regional authorities. In most states, however, the public rights-of-way are owned and controlled by a patchwork of local governments. This raises many state constitutional and local law issues that must be resolved state-by-state and region-by-region.

The Choice of Entity To Perform a Function. The primary steps in developing an ATMS system are design, construction, operation. and maintenance. An examination of the provisions corresponding to the modules reveals that the model assumes that all functions will be performed by the private sector. In theory, many permutations are possible; for example, one entity might design a system, another might build it, and a third might operate

Figure 5

ATMS Modular Franchise Agreement



and maintain it. In practice, however, a single entity is likely to be responsible for all those functions, with the principal variable being how each element will be financed. Another likely possibility, however, is that state or regional transportation authorities will be responsible for system design, and that the private sector will carry out the remaining steps in developing and running a system.

Range of Service Options. Another dimension that must be addressed by any agreement is the range of services to be provided by a particular franchisee. Service Options I and II apply only to Module A. Service Options III, IV, and V might each apply to each of the four remaining modules.

I. ATMS Free: This option provides that the franchisee will deliver ATMS services and traffic data generated by the system at no charge, and will not provide ATIS services.

II. Basic ATIS: Under this option, the franchisee will provide ATMS and traffic data, and will also provide basic ATIS services at no charge.

III. ATMS Plus Data: This option is the same as Service Option I, except that the franchisee may sell data generated by the system, either to the public in general or to value added resellers.

IV. Sale of ATIS: This option is the same as Service Option II, except that ATIS services will not be bundled with ATMS as a public good, but will be sold to the public.

V. ATIS and Data: Under this option, the franchisee will provide ATMS, may sell ATIS services (as in Service Option IV), and may sell data generated by the system (as in Service Option III).

Provision of Additional Services. The model franchise agreement also provides for what is essentially a sixth service option, namely the provision of additional services that might be possible as a result of construction of ATMS. Rather than establish a separate service option, however, each module simply provides that the franchisee may provide such other services if the franchisor agrees and the parties agree on terms. Since it is unclear what the additional services might be, and no services may actually be provided without subsequent agreement, it seems unnecessary and more flexible to establish a separate option for this possibility. Note that this provision effectively allows the parties to expand the range of service options by entering into a separate agreement, but without requiring the grant of an additional franchise.

There are two types of additional services: "Other ITS Services" and "Ancillary Services." Other ITS Services are services within the conception of ITS that are made possible by the construction of the system but that the agreement at its inception does not contemplate will be provided by the system. Ancillary Services are services that do not use the system or, if they do use some of the facilities of the system, fall outside the concept of ITS services. Examples of ancillary services are the right to operate restaurants, rest areas, or other concessions in the rights-of-way, installation of fiber optic lines for non-ITS purposes, or the use of fiber installed as part of the system for other purposes, such as leasing of excess capacity to third parties.

The Exclusivity of the Franchise. The model assumes that any ATMS franchise will be exclusive, simply because at this point it appears unlikely that a viable competitive market for ATMS services can be developed. Nevertheless, it may be desirable for the franchisor to be able to install parallel facilities in those cases in which redundancy and reliability demand it. Examples of this would be back-up control centers and surveillance equipment. For this reason, the model specifically provides that the franchisor may build its own system if it chooses.

Financing Options. Although arranging financing for design and construction is a critical step in the development of an ATMS system, the model franchise does not address that issue directly, and there is no section of the document devoted to financing of the project. Modules A through E touch on the question of financing and illustrate that how the project will be financed will vary greatly depending on the profitability of the project and other factors, but they do not discuss how financing would be obtained. Such issues are largely outside the scope of this document, which addresses the operational relationship between the parties. Nevertheless, the issue is central to the development of ATMS, and so potential financing mechanisms need to be understood.

Financing could be obtained through a number of sources, using a variety of mechanisms. The public sector has different options than the private sector, and any given project will require its own peculiar combination of sources and mechanisms.

For example, under Module A, essentially all the financing for the development of the system would come from the public sector. The private sector partner would have to have sufficient funds to conduct its operations on a day-to-day basis, but practically all of its funding for the construction, design and operation of the system would come from the franchisor. The franchisor could raise the necessary funds either through general tax revenues, by levying a special tax, by issuing general obligation bonds backed by the government's general taxing authority, or by issuing revenue bonds backed by revenues from the project. Which of these options is available depends on a number of factors, such as whether the project is deemed to be for a public purpose, whether the borrower requires the specific authority to borrow money for such a purpose, and if so, whether it has that authority.

There might also be federal funding available for part of the project. If the franchisor is a local government agency, there might be state funding available, derived either from tax revenues or bond financing.

At the other extreme, under Module E, the public sector would probably make no contribution to the project. The private sector partner could finance the project by seeking equity contributions from investors, using cash reserves, borrowing money in the private capital markets, or forming a joint venture to share the expense with other private entities. As a practical matter, such a project would be financed through a combination of means, but would likely depend heavily on the issuance of debt instruments.

Any combination of these mechanisms could be used to finance the modules that anticipate a combination of private and public funding. For example, Modules C and D note that the public sector's lower cost of borrowing would help reduce costs for the private sector. If the franchisor were to issue bonds dedicated to the project with the understanding that the franchisee would make payments to the franchisor to allow the franchisor to repay the debt, the reduced costs might make an otherwise marginal project profitable.

Financing is critical for the obvious reason that without adequate funds no project can be built. Before the specific financing mechanism for a project can be established, however, a more fundamental question must be addressed. That question is whether the project is "bankable," or structured in a way that it will attract private capital. If a project is not bankable, the private sector partner will not willingly invest its own funds, and will have trouble attracting debt financing. In addition, the public sector, which will almost certainly issue some amount of debt, will be unable to market its bonds. Therefore, in addition to the availability of the basic financing methods discussed above, some additional analysis is required.

The four factors that will determine the bankability of a project are: the latitude allowed under the authorizing legislation; the degree of agency financing or guarantees; revenues; and the degree of exclusivity.

If the authorizing legislation defines the scope of a project very narrowly and limits the public sector's freedom to consider alternative organizational structures and revenue sources, the project will be relatively less attractive. The model does not address that issue directly, but the importance of obtaining favorable authorizing legislation must be stressed.

Likewise, if the public sector is committed to financing the project or guaranteeing private financing, the financial risk of the project to the private sector will clearly decrease, and the project will again be attractive. One mechanism that can improve the bankability of a project is the establishment of revolving funds, in which the public sector issues bonds to establish a financing pool upon which the franchisee can draw for certain purposes, provided that revenue from the project is used to replenish the fund. Another alternative would be

government guarantees of loans to the franchisee, again with the goal of reducing the franchisee's boirowing costs.

The effect of a reliable revenue stream from the project is obvious: this model provides alternative structures based on the strength of the revenue stream projected for a particular project.

Finally, the degree of exclusivity is important because the presence of competition tends to reduce revenue and increase the risk of failure. As discussed above, this model presumes exclusivity, although it notes that it might not be desirable in all cases.

Certain characteristics are common to all the ATMS franchises, regardless of module:

- Specifies geographic extent and term
- Construction plan and schedule
- Area to be served
- Detailed annual operations plan
- Performance tests
- Interconnection requirements
- Technology upgrade requirements
- Recordkeeping and reporting requirements
- Insurance and performance guarantees
- Renewal and transfer provisions

4. The Model ATIS Franchise.

The ATIS draft franchise is much simpler than the ATMS franchise. The ATIS franchise contains the same basic provisions as the ATMS draft, except:

D. CONCLUSIONS

1. The number of operators sustainable in the defined market is a key issue.

   - Strong economies of scale will prevent multiple operators, regardless of the number of franchises awarded.

   - Market area and service definitions are critical to avoid killing potential competition while still allowing the franchisee economic viability.

   - Franchise term and levels of service affect the anticipated speed of technology change.

2. Competitive bidding is desirable.

3. Equipment Standardization can speed deployment and reduce investor risk.

4. Technological innovation is difficult to sustain once a franchisee is in place and insulated from competition.

5. The RFPs must be artfully written and yield a binding, economically viable venture for the private bidder.

6. ATMS is likely to be a pure public good with limited or no revenue potential. ATIS is likely to be a pure private good with open competition potential.

7. An orderly legal environment is essential to minimize investor uncertainty. Federal direction in the form of extensive models of local ordinances, RFPs, and franchises are important to minimize the uncertainties for local governments.

CHAPTER 6

RECOMMENDATIONS

This chapter will not revisit the various recommendations and conclusions listed in earlier chapters. Rather, it suggests next steps for the Federal Highway Administration, ITS America, States and MPOs to consider.

RECOMMENDATION #l: Generally ATMS should be publicly provided, except as noted below. Public provision requires adequate financing structures based upon taxpayer willingness-to-pay. ATMS must also receive high priority relative to competing projects of all types. Generally, the private sector should be encouraged to deploy and profit from ATIS, assuming consumer willingness-to-pay. Furthermore, the private sector should be encouraged and allowed to profit from deployment of integrated ATIS and ATMS if revenues from the combined systems are sufficient to earn a profit while at the same time permitting continual reinvestment and expansion in the ATMS/ATIS or because the public sector provides funds to make up the difference when the costs plus a reasonable return on private investment exceed the revenues.

RECOMMENDATION #2: Joint public and private sector cooperation is important. There is a wide range of worthy institutional models for both ATMS and ATIS. While FHWA should encourage diversity and experimentation, its primary focus must be on the institutional approaches most conducive to deployment.

RECOMMENDATION #3: FHWA should complete the model franchising package by preparing:

- Model state and local authorizing legislation;
- Model Joint Powers Authority;
- Model RFI package;
- Model RFP package;

- Model procedure for assessing risk and determining compensation; and
- Model evaluation criteria.

RECOMMENDATION #4: FHWA should develop model agreements for other institutional structures.

RECOMMENDATION #5: FHWA should move toward deployment demonstrations using the following as the most suitable models:

- Purely public ownership and provision of ATMS and basic ATIS;
- Franchising, both exclusive and competitive, of private sector providers of ATMS and/or ATIS;
- Competitive joint ventures among multiple private parties engaged in common provision of ATMS and competitive provision of ATIS;
- Intermediaries such as non-profit corporations or other organizations (e.g. Help Inc., MPOs, ITS America Chapters) that serve as umbrellas for cooperative undertakings by both the public and private sectors;
- System manager by a private vendor under competitive bid awarded by the public owner of the ATMS system;
- Exclusively private competition offering ATMS and ATIS services; and
- Open Solicitation of a public/private joint venture of an ATMS/ATIS system.

The need for continued public/private sector cooperation is evident in the scope of unknowns still facing ATMS/ATIS deployment. The Study recommends FHWA and ITS AMERICA coordinate further on the following topics:

- The costs and economies of scale of ATMS systems and ATIS systems;
- The vulnerability of particular deployment strategies to short run gamesmanship putting at risk long run benefits;

- The federal role in standardization; and
- Study of taxpayer and consumer willingness-to-pay for ATMS and ATIS.